MERRIMACK RIVER BASIN
WOLFEBORO, NEW HAMPSHIRE

CRESCENT LAKE DAM
NH 00309
N.H. NO NAME 107

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS, 02154

OCTOBER 1978

UNCLASSIFIED

CURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

REPORT NUMBER: NH 00309	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
TITLE (and Subtitle): Crescent Lake Dam ATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL AMS	5. TYPE OF REPORT & PERIOD COVERED: INSPECTION REPORT
	6. PERFORMING ORG. REPORT NUMBER
AUTHOR(s): .S. ARMY CORPS OF ENGINEERS EW ENGLAND DIVISION	8. CONTRACT OR GRANT NUMBER(s)
PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
CONTROLLING OFFICE NAME AND ADDRESS EPT. OF THE ARMY, CORPS OF ENGINEERS EW ENGLAND DIVISION, NEDED 24 TRAPELO ROAD, WALTHAM, MA. 02254	12. REPORT DATE: October 1978 13. NUMBER OF PAGES: 63
MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

DISTRIBUTION STATEMENT (of this Report)

PROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

SUPPLEMENTARY NOTES

ver program reads: Phase I Inspection Report, National Dam Inspection Program; wever, the official title of the program is: National Program for Inspection of n-Federal Dams; use cover date for date of report.

KEY WORDS (Continue on reverse side if necessary and identify by block number)

MS, INSPECTION, DAM SAFETY,

errimack River Basin
olfeboro, New Hampshire
ributary to Lake Winnipesaukee aka as Smith River

ABSTRACT (Continue on reverse side if necessary and identify by block number)

Xe dam is a cut stone masonry dam with a central timber section. THe dam s 131 ft. long and 14.7 ft. high. The spillway of the dam is considered to e inadequate on that it can only pass 26% of the spillway test flood without vertopping the dam. There are remedial acitons which must be implemanted by he owner within one year of the receipts of this report.

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

SEP 6 1979

REPLY TO
ATTENTION OF:

NEDED-E

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

Inclosed is a copy of the Crescent Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis. A brief assessment is included at the beginning of the report.

The preliminary hydrologic analysis has indicated that the spillway capacity for the Crescent Lake Dam would likely be exceeded by floods greater than 26 percent of the Probable Maximum Flood (PMF), the test flood for spillway adequacy. Our screening criteria specifies that a dam of this class which does not have sufficient spillway capacity to discharge fifty (50) percent of the PMF, should be adjudged as having a seriously inadequate spillway and the dam assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The term "unsafe" applied to a dam because of an inadequate spillway does not indicate the same degree of emergency as that term would if applied because of structural deficiency. It does indicate, however, that a severe storm may cause overtopping and possible failure of the dam, with significant damage and potential loss of life downstream.

It is recommended that within twelve months from the date of this report the owner of the dam engage the services of a professional or consulting engineer to determine by more sophisticated methods and procedures the magnitude of the spillway deficiency. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed. During periods of unusually heavy preciptiation, round-the-clock surveillance should be provided.

NEDED-E
Honorable Hugh J. Gallen

I have approved the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the non-Federal Dam Inspection Program.

A copy of this report has been forwarded to Water Resources Board, the cooperating agency for the State of New Hampshire. This report has also been furnished to the owner of the project, the Town of Wolfeboro, Board of Selectmen, Wolfeboro, New Hampshire 03894.

Copies of this report will be made available to the public, upon request to this office, under the Freedom of Information Act, thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for the cooperation extended in carrying out this program.

Sincerely,

Max B. Scheider

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

CRESCENT LAKE DAM
NH 00309

MERRIMACK RIVER BASIN
WOLFEBORO, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	N.H. No Name 107 (Crescent Lake Dam), I.D. NH 00309
State Located:	New Hampshire
County Located:	Carroll
Stream:	Tributary to Lake Winnipesaukee aka as Smith River
Date of Inspection:	June 6 and 7, 1978

BRIEF ASSESSMENT

Crescent Lake Dam is a cut stone masonry dam with a central timber section. The dam is 131-ft long and 14.7-ft high. The entire dam length serves as an overflow section. The overall physical condition of the dam is good to fair.

The spillway of Crescent Lake Dam is considered inadequate in that it can only pass 26 percent of the spillway Test Flood without overtopping the abutments. The determination of the spillway capacity was made according to Corps of Engineers screening criteria and should be verified by the owner using more sophisticated and accurate methods and procedures.

Recommended actions to be carried out by the owner within 12 months of receipt of this Phase I Report are summarized in Section 7. The most important of these is the provision of the safe access to the sluice gate during high lake levels, the acquisition of additional data to assess the need for additional spillway capacity, and the assembly of a complete set of design documents for the dam. Other recommended actions include cleaning timber at the spillway section and restoration of missing masonry blocks at the timber dam abutments.

Robert Gershowitz, P.E.

This Phase I Inspection Report on Crescent Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe condition be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

TABLE OF CONTENTS

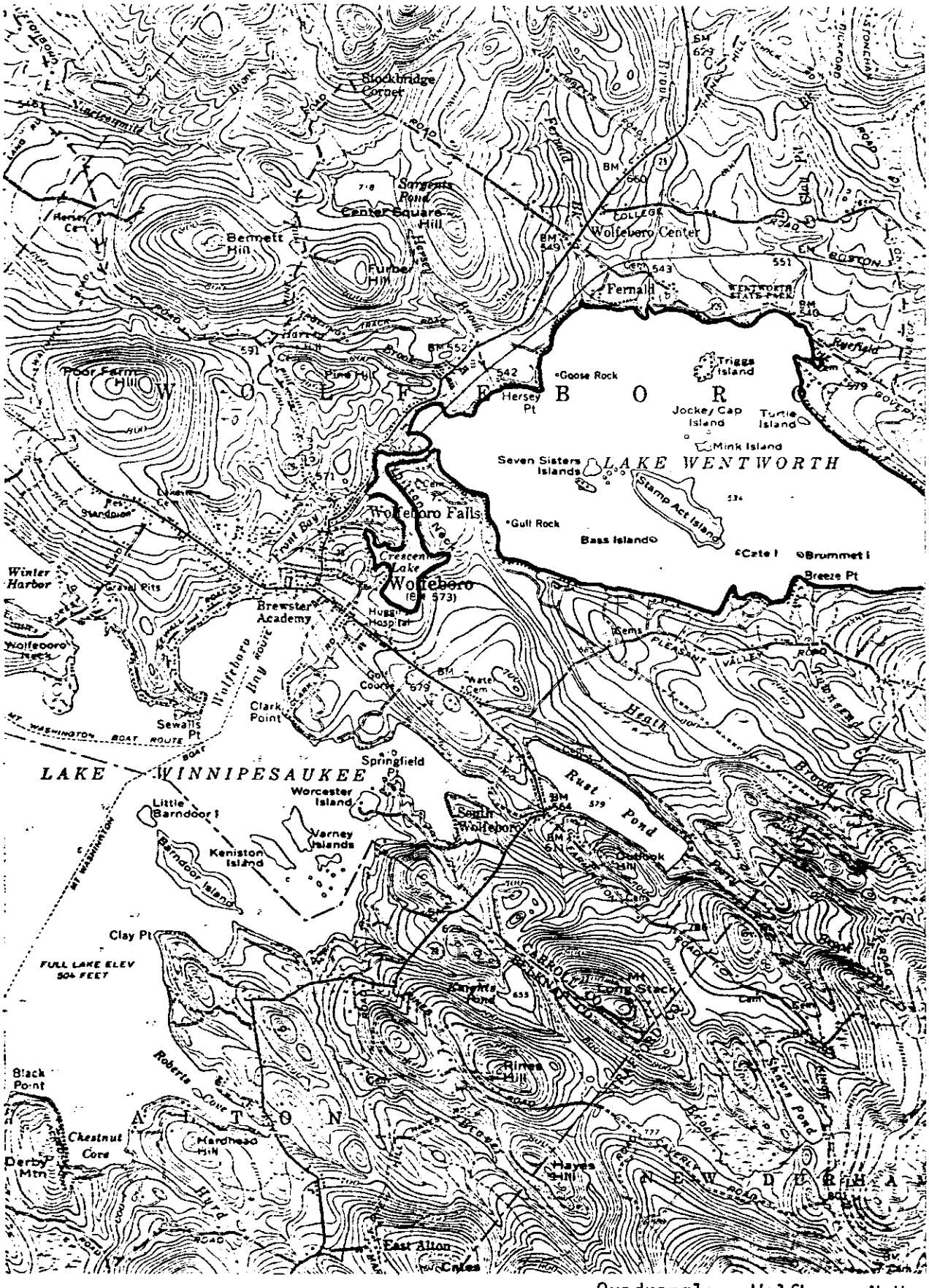
(Continued)

APPENDICES

C R E S C E N T L A K E D A M

NH NO NAME 107

View of the dam from downstream showing timber section and its left masonry abutment. Note that some masonry blocks are missing from the abutment. The spillover section is to the right of the picture.



Quadrangle: Wolfboro, N.H.
Scale: 1:62,500

VICINITY MAP

PHASE I INSPECTION REPORT

NO NAME 107 - CRESCENT LAKE DAM NH 00309

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. HARRIS-ECI ASSOCIATES has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed was issued to HARRIS-ECI ASSOCIATES under a letter of June 7, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0305 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Project Description

a. Location

Crescent Lake Dam is located on the Smith River in the Town of Wolfeboro, Carroll County, New Hampshire. Smith River is a tributary of Lake Winnipesaukee and is part of the Merrimack River primary drainage basin.

b. Description of Dam and Appurtenances

Crescent Lake Dam is a rough cut stone gravity structure with a central timber section. The dam is built across the natural outlet of Crescent Lake which is a tributary of Lake Winnipesaukee and is locally known as Smith River. The dam was built in 1854 and the masonry section was faced with a concrete wall on the upstream side in 1957. The timber section was rebuilt a number of times, most recently in the 1950's. The entire masonry section serves as an overflow section. The longer part of the masonry spillway is to the left of the timber section. The left abutment cutoff has been improved by the addition of a 10-inch thick concrete wall that is an extension of the facing concrete, and which ties the dam into higher ground. The right spillway masonry section is quite short and ties into a ledge rock outcrop. The entire dam is apparently founded on ledge rock. The timber dam structure spans between massive cut stone masonry abutments which are, in fact, widened portions of the normal spillway sections. The timber structure contains a 42-inch square low level outlet sluice used to control the lake surfaces of Crescent Lake and Lake Wentworth. These two lakes are connected by means of a channel and share a common water surface elevation. The facing wall of the masonry spillway section has iron pipe flash pins set into its top surface, but no flash boards were in use on the days of inspection and no use of flash boards is being considered.

Crescent Lake and Lake Wentworth have a combined surface area of 3,166 acres and impound 12,700 acre-feet of water derived from a drainage area of 36 square miles.

The overall length of the dam is approximately 131 feet and has a height of 14.2 feet above the river bed level.

No drawings exist for this dam, but pertinent details have been incorporated in field inspection sketches appended as Drawings 1 and 2. The downstream channel of Smith River has a ledge rock bottom at the dam and is moderately steeply sloped.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection" by the U.S. Department of the Army, Office of the Chief of Engineers, the dam is classified in the dam category as being "Intermediate", since its storage is more than 1,000 acre-feet but less than 50,000 acre-feet. The dam is also classified as "Small" because its height is less than 40 feet. The overall size classification is the largest of these two classifications, and accordingly Crescent Lake Dam is classified as "Intermediate" in size.

d. Hazard Classification

The dam has been listed in the National Inventory of Dams as having high hazard potential, on the basis that in the event of failure of the dam and its appurtenances, excessive damage could occur to downstream property together with the possibility of the loss of more than a few lives. The current inspection concurs with this classification, because the dam impounds a very large volume of water which in the case of a hypothetical dam failure could inundate low lying downstream areas without time to institute emergency evacuation procedures.

e. Ownership

Crescent Lake Dam is owned by the Town of Wolfeboro. Operational control is delegated by the Town to a private citizen who formerly had an owning interest in the facility.

f. Operator

Crescent Lake Dam is presently operated by Mr. Thaddeus Berry, a private citizen of Wolfeboro, New Hampshire, on behalf of the Town of Wolfeboro.

g. Purpose of the Dam

The purpose of the dam originally was to regulate the water supply for a small downstream power dam that has little effective storage. It still is used for that purpose in addition to serving to regulate the levels of Crescent Lake and Lake Wentworth.

h. Design and Construction History

No data was recovered in the files of the N.H. Water Resources Board (NH-WRB) or the Town of Wolfeboro relating to the design and construction of the dam. The date of 1854 is clearly chiseled on one of the granite blocks on the left abutment near the sluice operating platform. The concrete facing is inscribed with the date of 1957.

The timber section of the dam was reconstructed some time in the 1950's according to Mr. Thaddeus Berry who is currently in charge of operating the dam, and who had an owning interest in the structure at that time. According to Mr. Berry, the dam was rebuilt according to the previous design using heavy bridge timbers salvaged from an abandoned railroad branch line. According to Mr. Berry, the dam site was dewatered, and the timber section reconstructed in the dry. The bottom of the timber dam rests on a cast iron mud sill, as per Mr. Berry's account.

i. Normal Operating Procedures

The normal operating procedure is to regulate both the lake levels of Crescent Lake and Lake Wentworth, at the same time releasing enough water for the needs of a small downstream power dam, used to power machinery for excelsior production. According to data uncovered in the files of NH-WRB, the agreement at the time of the proposed sale of the dam to the Town of Wolfboro in 1958 allowed the previous owner to draw water from the lakes sufficient for its power needs, provided that:

- The level of Crescent Lake and Lake Wentworth shall not be permitted to fall 18 inches below the top of dam (Elevation 534.83) between June 15 and August 1 of any year.

- The lake levels shall not be permitted to fall more than 30 inches below Elevation 534.83 between August 1 and Labor Day of any year.

- The level of the lakes shall not be permitted to fall more than 36 inches below 534.83 between Labor Day and September 15 of any year.

- No minimum lake levels need be maintained between September 15 of any year to June 15 of the following year.

According to the Chief Dam Operator, an attempt is made to regulate summer time lake levels at elevations no higher than 6 to 8 inches over spillway crest level in order to avoid high water complaints from shore line residents. This control is achieved by use of the low level outlet sluice gate. The lake levels are drawndown at least one foot below spillway crest level in the winter time for control of ice damage and in anticipation of snowmelt water inflows in the spring.

The problem of regulating the levels of Crescent Lake and Lake Wentworth to achieve full pool in the early summer is the subject of extensive memoranda in the NH-WRB files.

1.3 Pertinent Data

a. Drainage Area: 36 square miles

b. Discharge at Dam Site

Maximum known flood at dam site:	1,000 cfs (estimated)
Warm water outlet at pool elevation:	175 cfs at Elev. 534.50
Diversion tunnel low pool outlet at pool elevation:	NA
Diversion tunnel outlet at pool elevation:	NA
Gated spillway capacity at pool elevation:	NA
Gated spillway capacity at maximum pool elevation:	NA
Ungated spillway capacity at maximum pool elevation:	1,780 cfs at Elev. 537.17
Total spillway capacity at maximum pool elevation:	1,780 cfs at Elev. 537.17

c. Elevation (feet above MSL)

Top of dam:	537.17
Maximum pool, design surcharge:	NA
Full flood control pool:	NA
Recreation pool:	534.5
Spillway crest:	534.5
Upstream portal invert diversion tunnel:	NA
Downstream portal invert diversion tunnel:	NA
Streambed at centerline of dam:	Elevation 522.5 (estimated)
Maximum tailwater:	Unknown; estimated at elevation 529.25 at time of inspection

d. Reservoir

Length of maximum pool	4.00 miles	Combined Crescent Lake and Lake Wentworth
Length of recreation pool:	3.98 miles	
Length of flood control pool:	NA	

e. Storage (acre-feet)

Recreation pool:	12,700 AF
Flood control pool:	NA
Design surcharge:	NA
Top of dam:	21,320 AF Elev. 537.17

f. Reservoir Surface (acres)

Top of dam:	3,166 acres (Elev. 534.5)
Maximum pool:	NA
Flood control pool:	NA
Recreation pool:	3,166 acres (Elev. 534.5)
Spillway crest:	3,166 acres (Elev. 534.5)

g. Dam

Type:	Rough cut masonry stone gravity dam with timber dam regulating section
Length:	131.5 feet
Height:	14.7 feet
Top width:	6 feet
Side slopes - Upstream:	Vertical
- Downstream:	Varies; approximately 1 vertical on 4 horizontal to 1 on 2 horizontal
Zoning:	NA
Impervious core:	NA
Cutoff:	Concrete facing wall between 10 to 20-inch high
Grout curtain:	Unknown, none believed installed

h. Diversion and Regulating Tunnel

Type:	NA
Length:	NA
Closure:	NA
Access:	NA
Regulating facilities:	NA

i. Spillway

Type:	Spillover gravity dam section
Length of weir:	130 feet
Crest elevation:	534.5
Gates:	None
U/S Channel:	Crescent Lake
D/S Channel:	Overbank flow to Smith River (a tributary to Lake Winnipesaukee)

j. Regulating Outlets

Low level outlet:	One 3.5 x 3.5 outlet gate centerline elevation estimated at 522.5
Controls:	Wooden sluice gate, rack and pinion hoist
Emergency gate:	None
Outlet:	Smith River channel

SECTION 2

2. ENGINEERING DATA

2.1 Design

No data is available in the files of the New Hampshire Water Resources Board or the owner relating to the design of the dam in regard to stability, spillway capacity or structural strength of the timber section.

2.2 Construction

No data is available in the files of the NH-WRB or the owner relating to the construction of the dam. The oral account of Mr. Thaddeus Berry of the reconstruction of the timber section in the 1950's is covered in Section 1.2 - h.

2.3 Operation

The current operation practices are covered in Section 1.2 - i. According to data in the NH-WRB files, the following high water occurrences have been documented:

Date	Lake Level above Spillway Crest
1867-1888	1.9 feet
1920	1.29 feet (15 1/2 inches)
April 19, 1933	1.67 feet (20 inches)
March 22, 1936	1.83 feet (22 inches)

2.4 Evaluation

a. Availability

Engineering data and documentation of the physical features of Crescent Lake Dam are virtually non-existent. A program of data acquisition and documentation is required.

b. Adequacy

The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Validity

Available data in the form of inspection reports and dam records in the files of the NH-WRB are inconsistent and need to be reassessed and evaluated against an actual record set of as-built drawings and details.

There is some confusion about the spillway crest elevation of the dam which is variously given as 534.27 and 534.83. Levels taken during the field inspection showed that the top of the upstream concrete cutoff and facing wall is at elevation 534.50 and that the dam masonry blocks downstream of the wall vary in height approximately 0 to 8 inches above the top of the concrete wall. The levels taken during the field inspection used the staff gage as a basis for the elevation datum.

SECTION 3

3. VISUAL INSPECTION

3.1 Findings

a. General

Crescent Lake Dam is in good to fair physical condition, even allowing for 124 years of age. The low masonry structure has been able to withstand all lake discharges passing over it, but has suffered some damage at its abutments attributed to vandals. It is a remarkable monument to the ability of early New England stone masons.

b. Dam

The low masonry dam is almost entirely a spillway structure. The left abutment spillway section is the longer one and the spillway section probably does not exceed 6 to 7 feet in height. The masonry consists of large rough trimmed granite blocks up to 4 cubic feet in volume laid up dry, and exceedingly well interlocked and chinked in the manner typical of New England dry wall construction. The upstream face of the dam is vertical and has been faced in 1957 with a concrete cutoff and facing wall 10 to 24 inches in thickness which extends beyond the original masonry construction and ties into the higher ground at the left abutment.

Judging from the ledge rock outcrops visible in the stream channel and the immediate vicinity of the dam, it seems probable that the masonry dam is founded on a variety of medium grained granitic ledge rock. The masonry dam is approximately 6-foot wide at the top and the downstream face slopes irregularly at slopes varying between 4 H on 1 V to 2 H on 1 V. No signs of erosion were noticed downstream of the masonry dam as a result of spillover.

The masonry dam section at each end of the timber section which closes off the natural outlet of Crescent Lake has been increased to build up two massive abutments approximately 20-foot wide by 10-foot long along the dam axis. The timber dam abutment tops are at or near the level of the spillway crest; however, several granite blocks from the top course of these abtuments have been tipped into the channel of the Smith River by vandals.

One-inch diameter flash pins have been inserted in the top of the upstream concrete facing wall at approximately 6 feet centers. There are no flash boards in evidence at the dam site and the Chief Dam Operator said that there are no plans to use flash boards to increase the lake levels because of high water complaints when the lake level exceeds 8 inches above the masonry crest.

A dam safety inspection report in the files of the N.H. Water Resources Board (NH-WRB), dated August 14, 1975, reported that the ".... dam has a small leak through the stone work on the left side....". An outcrop approximately 20 feet downstream of the dam had prominent joints that could be passageways for water under the dam and up into the stone work. However, water was spilling over the crest into the masonry stone work at the time of the field inspection and, hence, this leakage could not be verified. Based on past performance, the stone work is thought to have sufficient bulk and internal strength that any leakage would not affect its stability.

The timber dam section spans between the two massive masonry abutments described above. Details of the timber dam have been sketched during the field inspection and are reproduced in Drawing 2. The current timber section was rebuilt in the 1950's and utilized salvaged bridge timbers from an abandoned railroad line. The current arrangement of timber structural members is said to follow the previous design. All timbers appear to be in serviceable condition. A log sluice opening in the timber dam has been ineffectively sealed up and is leaking a considerable volume of water estimated at 50 gpm, (see Drawing 2).

The timber section contains a single sluice gate located at the bottom of the dam on the upstream face.

The gate is constructed of timber and measures approximately 3.5 feet by 3.5 feet(which was determined by indirect measurement of the width of the outlet and the length of the rack mounted on the gate stem). The gate stem is a 3.5 in. by 7 in. steel channel which is most likely a replacement stem, as most of these type gates have timber stems.

The manually powered operator contains a wooden handwheel driving a rack and pinion through a single spur gear reduction. The rack is directly fixed to the gate stem. One of the bearing caps which holds a gear shaft to the cast iron frame has apparently broken and been replaced by a wooden block which is not bolted to the frame. A new cap should be fabricated since this part is highly stressed and the operating mechanism will not function without it. Aside from the jury-rigged bearing cap, the sluice gate appears to be in satisfactory operating condition.

c. Appurtenant Structures

This dam does not contain any appurtenant structures.

d. Reservoir Area

Crescent Lake in the immediate area of the dam has a moderately sloping shore which is left in the natural state. The rim area up to the shoreline is covered with substantial tree growth, which has been locally removed in connection with sparse development. No readily apparent signs of instability were noted in the rim areas adjoining the lake. No signs of silting were observed in the lake at the dam site during the inspection.

e. Downstream Channel

The immediate downstream channel is well defined and has a ledge rock invert at the dam. The banks are 6 to 9-ft high and sloped from 2 H on 1 V.

The overbank area is well covered with brush and trees. It is estimated that some 20 to 30 structures are on or near both banks of the stream in the reach between Crescent Lake Dam and the downstream power dam serving the firm of O.P. Berry. The downstream channel is partly blocked by several large granite blocks which have been pried loose from the top course of the adjacent timber dam masonry abutments by action of vandals.

3.2 Evaluation

The overall physical condition of Crescent Lake Dam is good to fair for a 124-year old facility. Items affecting dam safety are:

1. Large stone blocks pried loose from the top of the masonry abutments and dumped into the stream partly blocking the outlet channel and tending to reduce the stability of the abutment.

2. A reported leak in the left spillway area which could not be checked because of water flowing over the dam at the time of inspection.

3. The area downstream of the spillway on the left abutment is intensely wooded and could possibly block part of the spillway section during very large flow of the PMF magnitude.

4. The cast iron bearing cap of the gear shaft of the gate hoist is broken and has been replaced by a wooden block. This repair may fail at a critical time.

5. The gate operating platform is considered to be too low in relation to the potential lake surface elevation during a PMF level flood, and could be swept away. There is no adequate dry access to the sluice platform at times of PMF lake levels.

SECTION 4

4. OPERATIONAL PROCEDURES

4.1 Procedures

The level of Crescent Lake and Lake Wentworth can be controlled at Crescent Lake Dam in conjunction with releases of water for power generation at a downstream dam. In the summer time, an attempt is made to keep lake levels within 6 to 8 inches above the dam crest, in order to avoid complaints concerning high water from lake shore property owners. Minimum lake levels in the summer have been stipulated in detail as part of the agreement whereby the dam was acquired by the Town of Wolfboro. Summer time releases through the sluice gate are governed by the stipulated high and low lake level limits and the water needs of the downstream power dam. The lake level is drawn down approximately one foot in the winter in order to minimize ice damage to shoreline property and to provide storage for spring time snow melt water. The daily regulation of the sluice gate has been delegated by the Town to Mr. Berry who has long experience in this matter because he previously had an owning interest in Crescent Lake Dam and currently owns the downstream power dam. The NH-WRB has given advice on the regulation of the lake during the spring snowmelt season.

4.2 Maintenance of the Dam

Currently, no scheduled maintenance of the dam is being carried out. Maintenance is on an as-needed basis. Repairs carried out in the past have been described above.

4.3 Maintenance of Operating Facilities

There is no scheduled maintenance of the operating facilities. Maintenance is on an as-needed basis, in conjunction with the frequent regulation of the sluice gate opening.

4.4 Description of any Warning System in Effect

There is no warning system in effect to provide a warning to downstream residents in case of dam accident.

4.5 Evaluation

Maintenance of the dam and the operating facilites is at a minimum and on an as-needed basis. Procedures should be better documented in line with the greater public interest in dam safety. A semi-annual dam inspection should be initiated using a visual check list format similar to the one used in this report. Maintenance should be scheduled and all visits to the dam site for maintenance, repairs and operation should be logged. Lake levels should be logged in conjunction with operating visits.

SECTION 5

5. HYDRAULIC / HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The evaluation of the hydraulic and hydrologic features of Crescent Lake Dam was based on criteria set forth in the Corps' Guidelines for Phase I Inspection, and additional guidance provided by the New England Division, Corps of Engineers. The Probable Maximum Flood (PMF) was estimated from guide curves for probable maximum flood for New England region, based on past Corps' studies. The PMF peak versus drainage area curves are presented in the section of Hydrologic Computations, Appendix D.

The PMF curve applicable for rolling areas was adopted for the estimation of the PMF peak of the reservoir. The PMF versus Drainage Area relationship can be expressed mathematically as follows:

$$Q = 2323 - 676.99 \log_{10} A$$

$$Qp = Q \times A$$

where:

Q = Unit peak discharge in cfs/square miles

Qp = Peak PMF discharge, in cfs, for the reservoir

A = Watershed area, in square miles, upstream of the dam axis.

The computed peak discharges of the PMF and one half of the PMF for a drainage area of 36 square miles using the above equation are 45,000 cfs

and 22,700 cfs respectively. A triangular shaped flood hydrograph was assumed for the inflow design hydrograph.

Both the PMF and one half of the PMF inflow hydrographs were routed through the reservoir by the modified Puls Methods, utilizing computer program HEC-1. The peak outflow discharges for the PMF and one half of the PMF are 12,748 cfs and 4,592 cfs, respectively. Both the PMF and one half of the PMF result in overtopping of the dam.

The stage-outflow relationship for the spillway and the reservoir stage-capacity were constructed using comparisons of both dam inventory data and planimetered areas, measured from 15-minute quadrangle topography maps. Reservoir storage capacity includes surcharge levels exceeding the top of the dam and the spillway rating curve assumes that the dam remains intact during routing. In the routing computations, the discharge through the low level outlet facilities was excluded due to its insignificant magnitude, as compared to the spillway discharge and the PMF. The spillway rating curve and the reservoir capacity curve are presented in the section of Hydrologic Computations, Appendix D.

Since the spillway of the dam is incapable of passing the PMF or one half PMF without overtopping the dam, an assessment of the downstream hazards due to a flood wave that would result with a hypothetical dam failure was also estimated. The magnitude of the flood wave was estimated using a generally accepted "rule of thumb" computational procedure promulgated by the New England Division, Corps of Engineer, in combination with sound hydrologic engineering judgement.

Calculations for flood routing of the dam break hydrograph for the downstream river reach are also given in the section of Hydrologic Computations. The computation shows that a hypothetical dam break involving the entire timber section between the massive abutments would release a lake discharge

of approximately 2,680 cfs and the flood stage in the immediate downstream would be about 5 feet. The stage computation is based on preliminary data and must be verified in detail. The flood stage could affect the structural stability of buildings in the downstream reach whose foundation tops are below the inundation level, and could cause injuries and deaths.

b. Experience Data

The maximum recorded spillway depth at Crescent Lake Dam was 1.9 feet, corresponding to a discharge of approximately 1,000 cubic feet per second.

c. Visual Observations

The entire dam with the exception of the concrete dam facing wall extension on the left abutment is a spillway section. The original cut stone masonry is an effective energy dissipating system at low heads over the crest. Heavy tree and brush growth on the overbank downstream of the left spillway section could obstruct part of the spillway if uprooted by erosive action of spillway waters during PMF magnitude flood events.

d. Overtopping Potential

As indicated in Section 5.1 - a., both the PMF and one half of the PMF when routed through Crescent Lake Reservoir, result in overtopping the dam. The spillway and reservoir surcharge capacities are too small to accommodate the peak flows. The PMF and one half PMF overtopped the dam by 6.06 feet and 2.06 feet respectively. These levels affect the stability of the structure, as discussed in Section 6. The spillway is only capable of passing a flood equal to 26 percent of the PMF without overtopping the dam. Since the PMF is the Spillway Test Flood for this dam, according to the Recommended Guidelines for Inspection of Dams by the Corps, the spillway capacity of the Crescent Lake Dam is considered "Inadequate".

SECTION 6

6. STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

Visual observations regarding the structural stability of the dam indicate that the dam's masonry spillway section stonework is laid up without mortar and, as a consequence, will probably not allow the build up of uplift pressures within the cross section of the dam. This effect is beneficial to the stability but poses problems with water tightness.

The concrete facing on the downstream side of the dam was added in 1957. Previous inspection reports indicated that a source of leakage had been discovered in the left spillway section, but because of the general overflow conditions on the days of inspection, this leak could not be located for verification. The stability of the dam is not thought to be affected by this leakage because headwater pressures are probably rapidly dissipated in the open masonry work and the blocks are massive enough and well interlocked to maintain stability. Nevertheless, until the leakage area can be inspected in the dry, without spillway water obscuring its source and quantity, no definite conclusions can be reached.

The missing masonry blocks from the timber dam section abutments constitute a weight reduction of the mass resisting the horizontal water thrust by gravity action, and should be restored for this consideration as well as hydraulic ones.

b. Design and Construction Data

No plans or cross sections exist for the dam and no foundation data is available. No assessment of structural stability is possible without a set of coherent as-built drawings.

On the basis of visual examination of the structure and the field inspection sketches, it is felt that the stability of the spillway sections and the masonry abutment sections is not of immediate concern, especially in view of the satisfactory service record of the dam in its 124-year existence.

The timber section of the dam has been framed as shown on Drawing 2. All dimensions are approximate. The framing at the sill is subject to revision since that part of the timber dam could not be seen and the conditions depicted in the sketch are the inspection team's interpretation of conditions described by Mr. Thaddeus Berry, the person in charge of the operation of the dam. If the timber framing does in fact correspond to what is shown on the sketch, then the stresses in the 2 by 8 in. timber plank dam face should be investigated for overstress at normal and PMF lake levels.

c. Operating Records

The dam has remained in service over 124 years and high water summaries in NH-WRB files for the years 1867-1888, 1920, 1933 and 1936 indicate that lake levels up to 1.9 feet over the dam's spillway crest have been experienced and have been withstood without significant damage.

d. Post Construction Changes

The concrete wall was added to the upstream face of the masonry spillway sections in 1957, and has an undetermined effect on the stability of the structure. If the concrete wall replaced some other less effective impervious barrier, then the stability of the dam is basically unchanged from what was intended by the original designer of the dam. If the concrete wall was meant to add an impervious barrier, to a previously pervious or porous structure, then the original design conditions have changed. In either case, the structure as it stands today has been in service for 21 years and stability will have to be assessed on current conditions even if they do not correspond to what was originally envisaged.

e. Seismic Stability

The dam is located in Seismic Zone 2 and, in accordance with the Recommended Phase I Guidelines, does not warrant seismic analyses.

SECTION 7

7. ASSESSMENT / REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The overall physical condition of Crescent Lake Dam is good to fair. The dam has an inadequate spillway capacity, capable of passing only 26 percent of the PMF without overtopping the abutment. The determination of the spillway capacity was made according to Corps of Engineers screening criteria and should be verified by the owner using more sophisticated and accurate methods and procedures.

Even though the dam is probably founded on granite ledge rock, overtopping the abutment carries an element of risk, in that adjacent gravity section could be undercut and destabilized. The capacity of the spillway section could be reduced by trees being uprooted during PMF level floods in the immediate downstream areas adjoining the spillway section and blocking the crest.

The stability of the timber dam abutments can be restored to their original values by replacing vandalized top course masonry blocks to their priginal position from their current location in the discharge channel.

Stresses in the members of the timber dam section should be computed using a properly dimensioned framing plan of the structure. The plan should contain information on the framing at the bottom sill which was not visible under tailwater during the inspection. The stresses should be computed for loading cases where the water level is at the top of the spillover section and also for the SDF condition. The stresses in the timber face planking are believed to be especially in need of assessment.

The low level outlet operating platform is believed to be unsafe at high lake levels and subject to being swept away at PMF levels. No safe dry access to this platform exists now at high lake levels from either abutment. The low level outlet gate hoist mechanism has a gear shaft bearing cap replacement made out of wood which could fail at a critical time and render the low level outlet inoperable which could result in higher spillway depths.

b. Adequacy of Information

The lack on in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Urgency

The urgency of performing the recommendations and remedial measures are detailed below.

d. Need for Additional Investigations

There is no need for further investigations in this phase of the program. Recommended investigations to be carried out by the owner are listed below.

7.2 Recommendations

It is recommended that the owner within 12 months after receipt of this Phase I Report assemble the following information:

a. Data Acquisition

(1) A complete set of as-built drawings of the dam, including details of foundation levels, details

of the concrete facing, details of the timber dam, spot elevations of the tops of masonry crest blocks downstream of the concrete facing wall, and details of low level outlet and its hoist.

(2) A topographic survey of the area downstream of the spillway sections including location of trees over 3 inches in diameter and showing details of the bank protection along the Smith River for approximately 150 feet downstream of the dam axis.

b. Investigations

Determine the spillway capacity of the dam using more sophisticated and accurate methods than were used in the Phase I screening methodology employed in this report, including the routing of the inflow through the lake. A tailwater rating curve should be computed for very large discharge volumes. Spillway and outlet rating curves should be adjusted for possible effects to submergence.

Based on the results of the spillway capacity analyses, the owner should formulate plans for augmenting the spillway capacity, if shown necessary.

7.3 Remedial Measures

a. Alternatives

Alternate actions to be considered in increasing the spillway capacity of the dam are:

(1) Increasing the abutment height as required to pass the SDF over the crest of the spillway. Provide adequate energy dissipation if needed.

(2) Lower the lake level to provide additional storage in anticipation of large flooding events.

(3) Provide additional spillway capacity by constructing an auxiliary spillway channel on either abutment.

(4) Lower the existing crest of the dam and maintain the current lake levels by the use of flash boards.

(5) A combination of the above methods.

b. O & M Maintenance and Procedures

The owner should initiate the following programs:

(1) A semi-annual inspection of the dam utilizing a visual check list similar to that used in this inspection report.

(2) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

(3) Assemble and keep on hand complete documentation of the dam design, as-built drawings, and any other data pertaining to the dam safety.

(4) Repair of low level outlet gate hoist bearing cap.

(5) Clearing timber and brush from the area downstream of the spillway section of dam for an approximate distance of 35 feet, regrading of the area and protection of stream bank slopes where the spillway water rejoins the stream.

(6) Removal of large abutment blocks from the downstream channel and restoring them to their former locations on top of the dam.

(7) The owner should establish a formal system with local officials for warning downstream residents in case of emergency. Round the clock surveillance should be provided by the owner during periods of unusually heavy precipitation.

APPENDIX A

CHECK LISTS:

- VISUAL OBSERVATIONS
- ENGINEERING, CONSTRUCTION MAINTENANCE DATA
- HYDRAULIC AND HYDROLOGIC DATA ENGINEERING DATA

CHECK LIST
VISUAL INSPECTION
PHASE 1

Name Dam N.H. NO NAME 107 (CRESCENT LAKE DAM) County Carroll State New Hampshire Coordinators

Date(s) Inspection June 6, 1978 June 7, 1978 Weather Cloudy Sunny Temperature 75°F 80°F

Pool Elevation at Time of Inspection 534.65 M.S.L. Tailwater at Time of Inspection 528.25 M.S.L.

Inspection Personnel:

Seymour Roth, June 7
David Kereks, June 7
Yin Au-Yeung, June 6
William Flynn, June 6
Lynn Brown, June 6
Recorder: Seymour M. Roth

Present for the owner on June 6: Mr. Guy Krapp, City Manager - Town of Wolfeboro
Mr. Thaddeus Berry, In charge of Dam Operation

Note: NA means not applicable

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE	No seepage could be observed because the dam was overflowing for the full length. Leakage observed during previous inspection could not be verified. Drawdown of the lake is not possible on short notice because of lake's very large storage area.	Reinspect downstream face of dam in detail during time when Crescent Lake is below crest of spillway in the late fall.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	On the left abutment, a 10-inch thick concrete cutoff and facing wall has been placed in front of the granite block masonry gravity structure and extended into higher ground On the right abutment, a 20-inch thick concrete cutoff and facing wall in front of granite masonry runs into higher exposed ledge rock. No leakage was observed at either end of the dam.	
DRAINS	None installed.	
WATER PASSAGES	At the center of the masonry dam, in line with the downstream channel of Smith River, a timber dam approximately 20 feet wide spans across massive abutments. The timber dam contains a wooden sluice gate estimated at 42 inches square. A previously used log sluice opening has been inadequately boarded up and is leaking.	Adequately close off unused log sluice opening to reduce through dam leakage to practicable minimum.
FOUNDATIONS	Ledge rock underlies the site and is exposed. The ledge rock is a medium grained granitic rock called quartz diorite.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	The dam was awash at the time of inspection. The 20-inch thick concrete cutoff and facing wall was added in 1957 and appears to have sustained no major cracking on the visible top surface.	
STRUCTURAL CRACKING	No structural cracking could be observed in the concrete facing wall top surface.	
VERTICAL & HORIZONTAL	The dam rest is composed of rough cut granite blocks, laid without mortar, but apparently well chinked and interlocked. The joints are open. The granite construction dates to 1854. The upstream concrete cutoff and facing wall constructed in 1957 forms the primary crest of the spillway and is in good vertical and horizontal alignment, varying approximately 1 inch over the length of the dam. The original granite construction behind the concrete facing wall is approximately 6 to 7-foot wide at the top. The tops of the granite blocks are from 0 to 8 inches higher than the top of the facing wall. Overflow water on the facing wall passes through the joints and chinks of the granite blocks behind the wall.	
MONOLITH JOINTS	None observed	
CONSTRUCTION JOINTS	The original masonry consists of massive granite stones, rough dressed, approximately 2 to 4 cubic feet each in volume laid up dry but well chinked and interlocked. Some top course stones of the massive river wall abutments supporting the timber dam section have been vandalized and tipped into the river bed below.	Restore vandalized stones to river wall abutments

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NA	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NA	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	NA	
VERTICAL & HORIZONTAL ALIGNMENT OF THE CREST	NA	
RIPRAP FAILURES	NA	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	NA	
ANY NOTICEABLE SEEPAGE	NA	
STAFF GAGE AND RECORDER	NA	
DRAINS	NA	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	The low level outlet consist of a 42-inch square sluice gate built into the face of the timber dam section. There are no concrete surfaces.	
INTAKE STRUCTURE	Not applicable	
OUTLET STRUCTURE	None provided. The sluice discharges directly into the channel of Smith River.	
OUTLET CHANNEL	Smith River has a ledge rock bottom downstream of the dam. The timber dam section is abutted by massive granite stone walls for the first 20 feet downstream of the dam axis.	
EMERGENCY GATE	None provided.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	The entire dam is an overflow structure. The granite masonry is faced on the upstream side by a 20-inch concrete wall whose top is level and smooth and has been provided with flash pins at approximately 6 feet on centers. No flash boards are in use, and no future use is intended. The granite blocks behind the concrete facing wall are irregularly laid with open joints. At very low overflow depths the water over the concrete wall runs between the open joints of the top course of the granite masonry blocks.	
APPROACH CHANNEL	None	
DISCHARGE CHANNEL	The water spilling over spillway crest on the left abutment flows into an intensely overgrown overbank area and then flows toward the downstream river channel. On the right abutment, the water flows behind the timber section abutment wall and joins the downstream channel downstream of it.	Remove trees and vegetation downstream of left abutment spillway section. Regrade ground as necessary to provide a clear spillway outlet channel.
BRIDGE AND PIERS	A timber walkway and gate operating platform have been provided over the timber dam section. There is no safe access to the low level outlet gate operating hoist at high overflow lake levels.	Provide a safe access to the low level outlet gate hoist from the right abutment during high lake levels.

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE SILL	NA	
APPROACH CHANNEL	NA	
DISCHARGE CHANNEL	NA	
BRIDGE AND PIERS	NA	
GATES & OPERATION EQUIPMENT	NA	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/ SURVEYS	NA	
OBSERVATION WELLS	NA	
WEIRS	NA	
PIEZOMETERS	NA	
OTHER	A staff gage for measuring the lake level has been provided at the gate operating platform near the right abutment.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENTATIONS
SLOPES	The lake rim of Crescent Lake are moderately flat and in the natural state. Development along the rim is sparse and the shores are mainly covered by substantial tree growth. No rim formation instability was readily apparent.	
SEDIMENTATION	There was not sedimentation apparent. Crescent Lake is connected to the larger Lake Wentworth and the combined volume of the lakes is very large minimizing sedimentation effects.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is known locally as Smith River. The channel is well defined moderately to steeply sloping, approx. 25-foot wide. There are no obstructions in the channel itself, but the overbanks are overgrown with trees and brush.	
SLOPES	The banks are well defined, approximately 6 to 8 feet high and have slopes of 1 vertical on 2 horizontal.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	None observed in immediate vicinity of dam. There is development further downstream at Wolfboro, approximately 20-30 structures.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Not available
REGIONAL VICINITY MAP	Available
CONSTRUCTION HISTORY	Not available in documented form. Some data available orally from owner.
TYPICAL SECTIONS OF DAM	Not available
HYDROLOGIC/HYDRAULIC DATA	Data pertaining to recommended operating rules and maintenance of lake levels is in the files of the N.H. Water Resources Board.
OUTLETS - PLAN	Not available
- DETAILS	
- CONSTRAINTS	
- DISCHARGE RATINGS	
RAINFALL / RESERVOIR RECORDS	Soma data available in files in N.H. Water Resources Board.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
DESIGN REPORTS	None available
GEOLOGY REPORTS	None available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available
POST-CONSTRUCTION SURVEYS OF DAM	None available. Past Inspection reports sheets are on file in the N.H. Water Resources Board.
BORROW SOURCES	Unknown
SPILLWAY PLAN - SECTIONS - DETAILS	Not available

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	Not available
MONITORING SYSTEMS	None
MODIFICATIONS	Dam was built in 1854. A concrete facing and cutoff wall was added to the upstream face of the masonry structure in 1957. The timber section of the dam has been rebuilt several times, the last time in the 1950's.
HIGH POOL RECORDS	Available for events of 1933 and 1936 in N.H. Water Resources Board files.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None available
MAINTENANCE OPERATION RECORDS	None available

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: N.H. NO NAME 107 (CRESCENT LAKE DAM)

Drainage Area Characteristics: 36 square miles on Crescent Lake

Elevation Top Normal Pool (Storage Capacity): 534.50

Elevation Top Flood Control Pool (Storage Capacity): NA

Elevation Maximum Design Pool: Elev. 537.17

Elevation Top Dam: Elev. 537.17

SPILLWAY CREST:

a. Elevation 534.50
b. Type Broad crest overflow
c. Width Varies from 9 inches to 2 feet
d. Length 130.17 (total)
e. Location Spillover Entire structure
f. No. and Type of Gates None

OUTLET WORK:

a. Type Wood sluice gate (3.5 x 3.5)
b. Location Center of timber structure
c. Entrance Inverts 522.75 (estimated)
d. Exit Inverts 522.75 (estimated)
e. Emergency Draindown Facilities None

HYDROMETEOROLOGICAL GAGES:

a. Type Staff Gage
b. Location Upstream face of dam, at timber structure
c. Records Unknown

MAXIMUM NON-DAMAGING DISCHARGE 1,000 cfs

APPENDIX B

PHOTOGRAPHS

ALL PHOTOGRAPHS TAKEN ON JUNE 6, 1978

CRESCENT LAKE DAM
NH NO NAME 107

Photo 1 - View of dam from the right abutment looking along the axis of the dam. The short right spillover section is in the foreground, showing the original masonry gravity section and the upstream concrete facing wall. Flashpins visible in foreground are not in use. The walkway over the timber dam section and the low level outlet sluice gate hoist are visible in the background.

Photo 2 - View of the left spillover section from the downstream side. The upstream face of the spillover section has a concrete facing similar to the one shown on Photo 1.

Photo 3 - View of the left masonry abutment of the timber dam from the right abutment. Note missing stones on the top course.

Photo 4 - View of the right masonry abutment of the timber dam.

Photo 5 - View of the upstream face of the dam from the lake. Note that the left spillover section of the dam is obstructed by tree growth downstream of it.

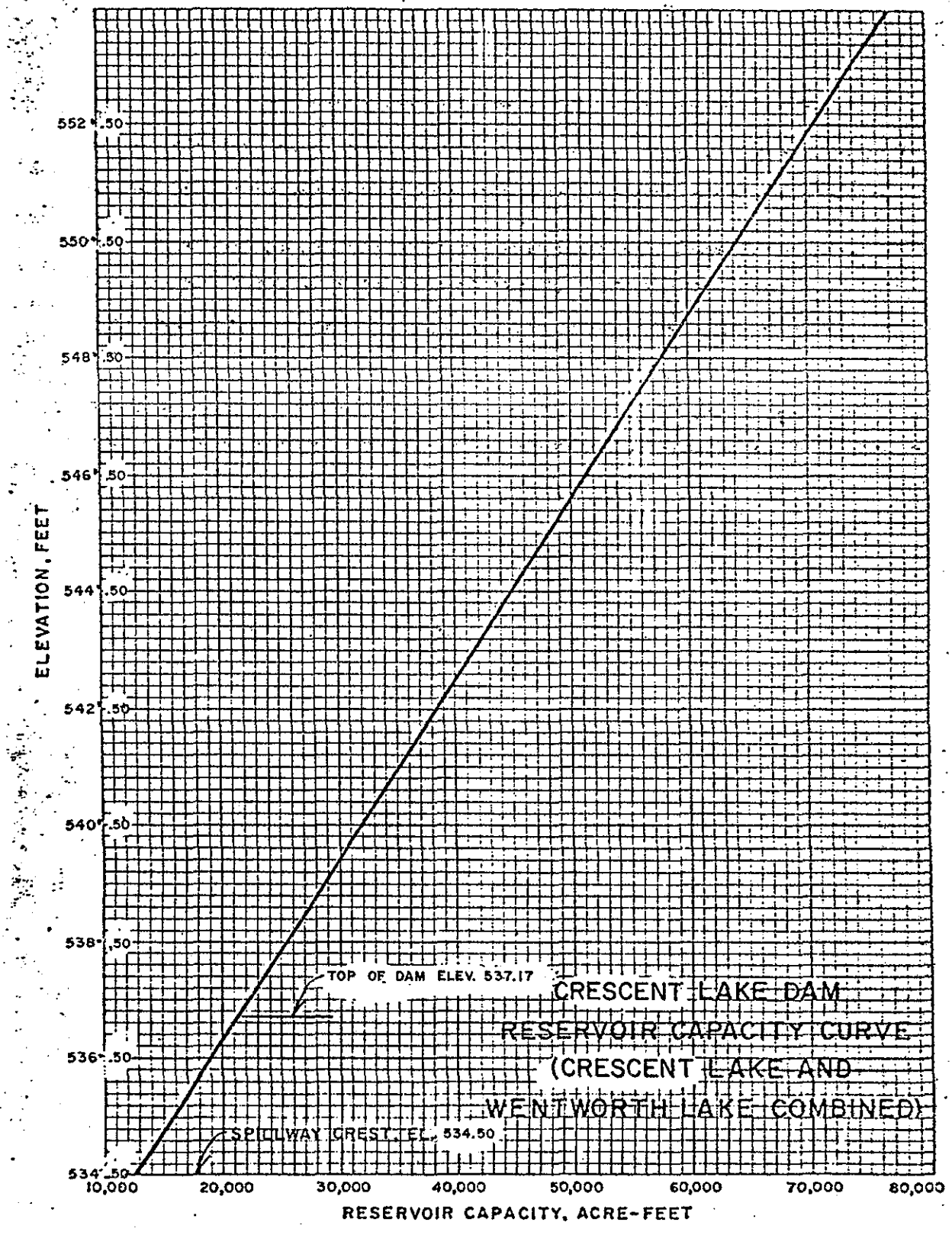
Photo 6 - View of the downstream channel of the Squam River.

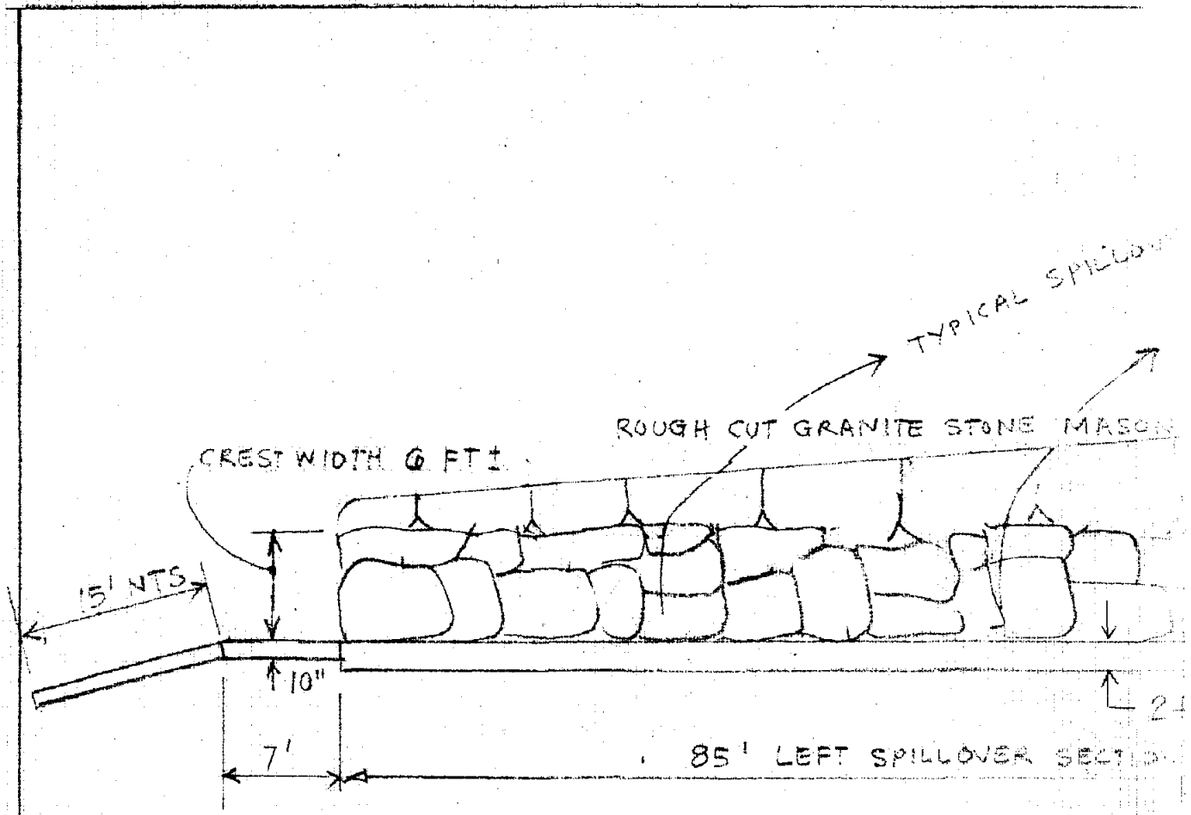
APPENDIX C

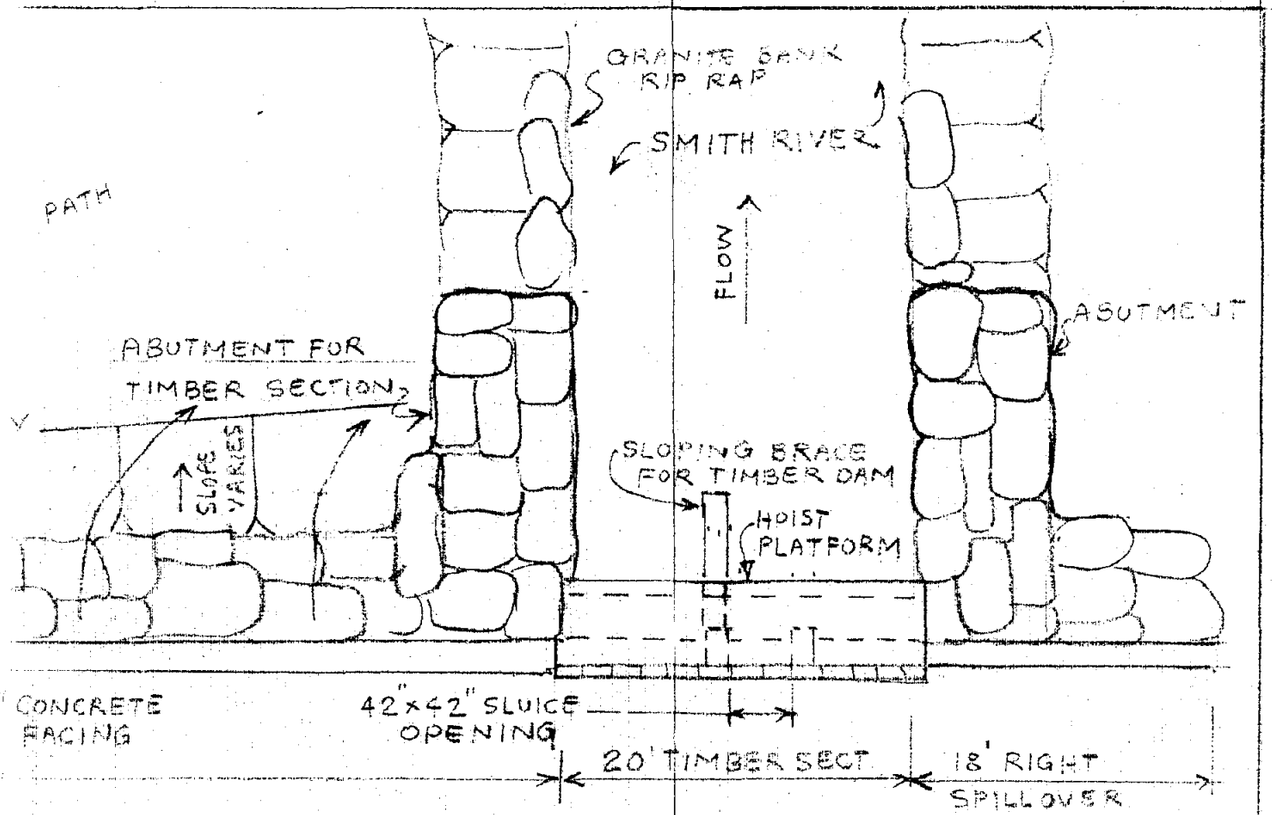
PLATES

PLANS & DETAILS OF DAM -	Drawings 1 & 2
GEOLOGIC MAP	Drawing 3

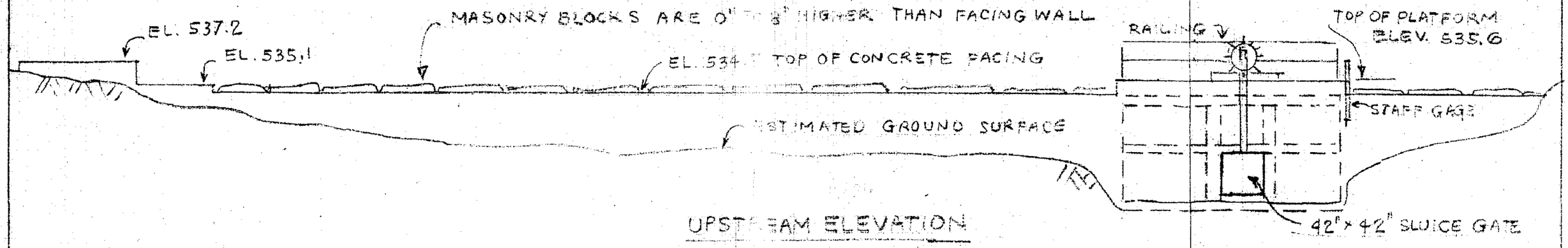
PLATE 4 APPENDIX D







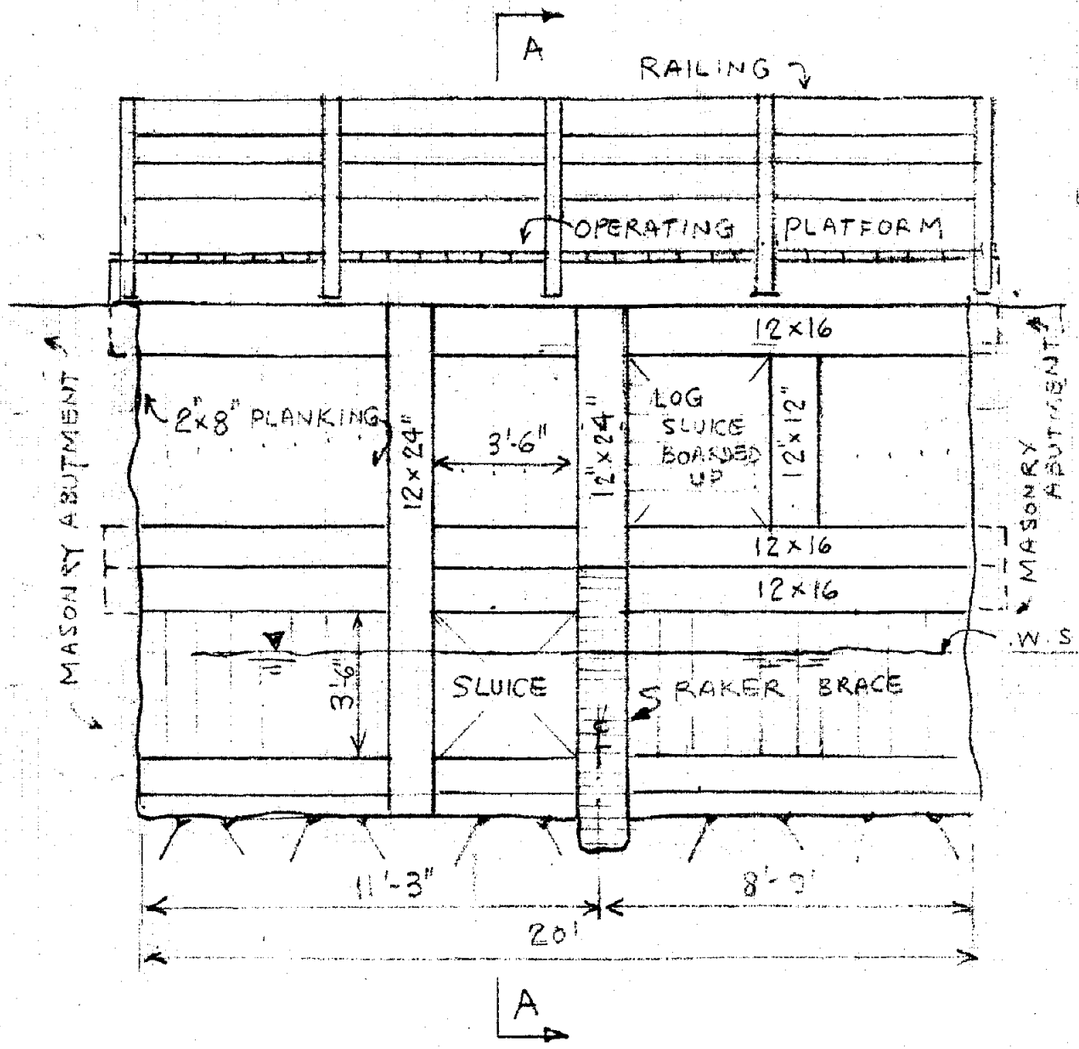
PLAN OF DAM



UPSTREAM ELEVATION

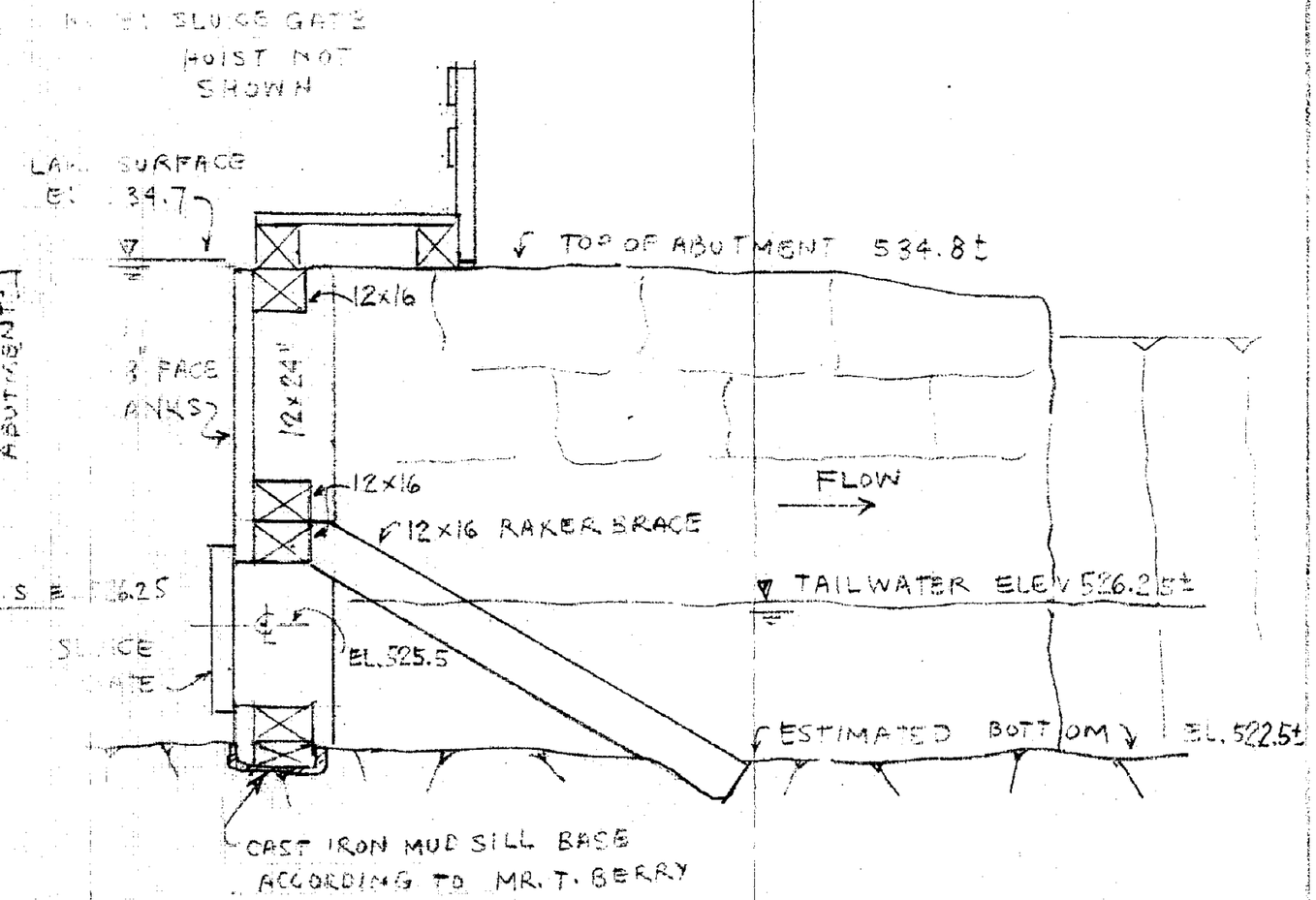
NOTE: ALL DIMENSIONS ARE APPROXIMATE
SKETCH IS DRAWN TO NO SCALE

HARRIS-ECI ASSOCIATES	
CRESCENT LAKE DAM	DWG.
FIELD INSPECTION SKETCH	1



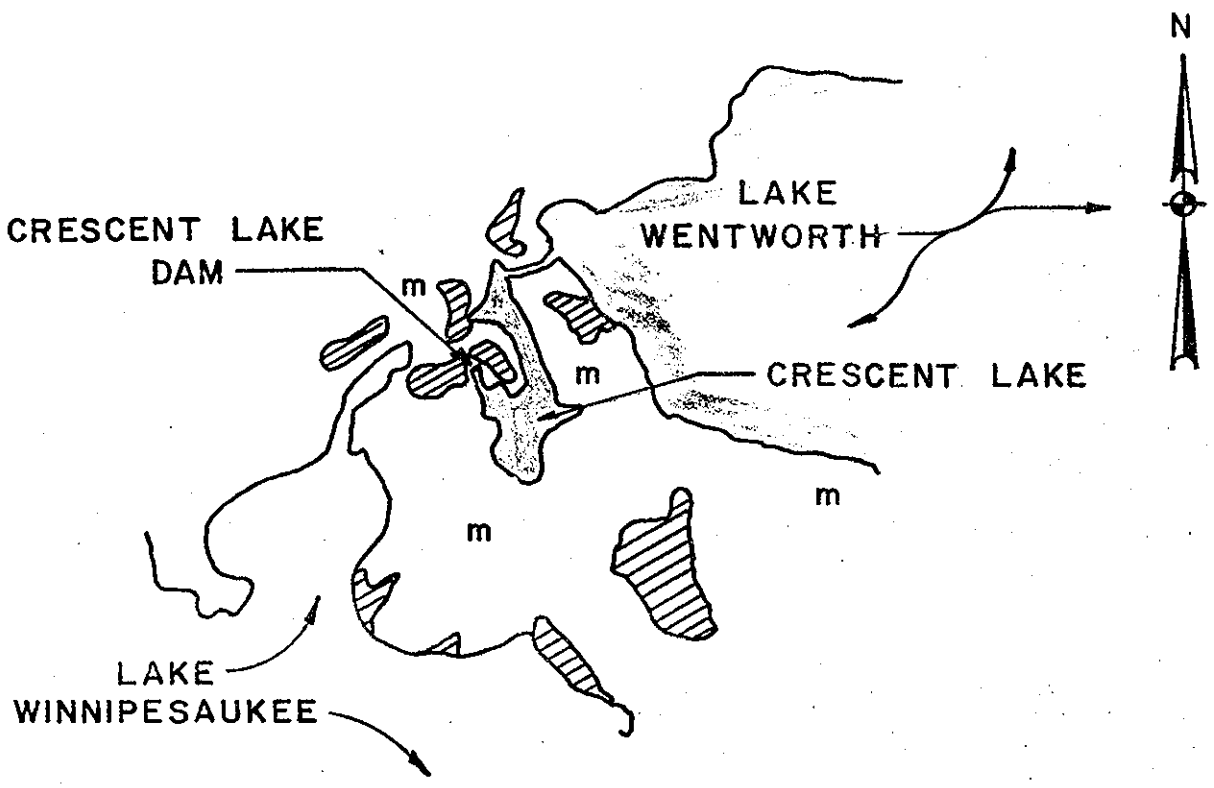
TIMBER DAM- DOWNSTREAM ELEVATION

SCALE 1/4" = 1'-0"



SECTION A-A

HARRIS-ECI ASSOCIATES	
CRESCENT LAKE DAM	DWG.
FIELD INSPECTION SKETCH	2



Scale: 1" = 1 Mile

LEGEND:

Quartz Diorite, Medium - Grained

m Ground Moraine (Till)

Contact

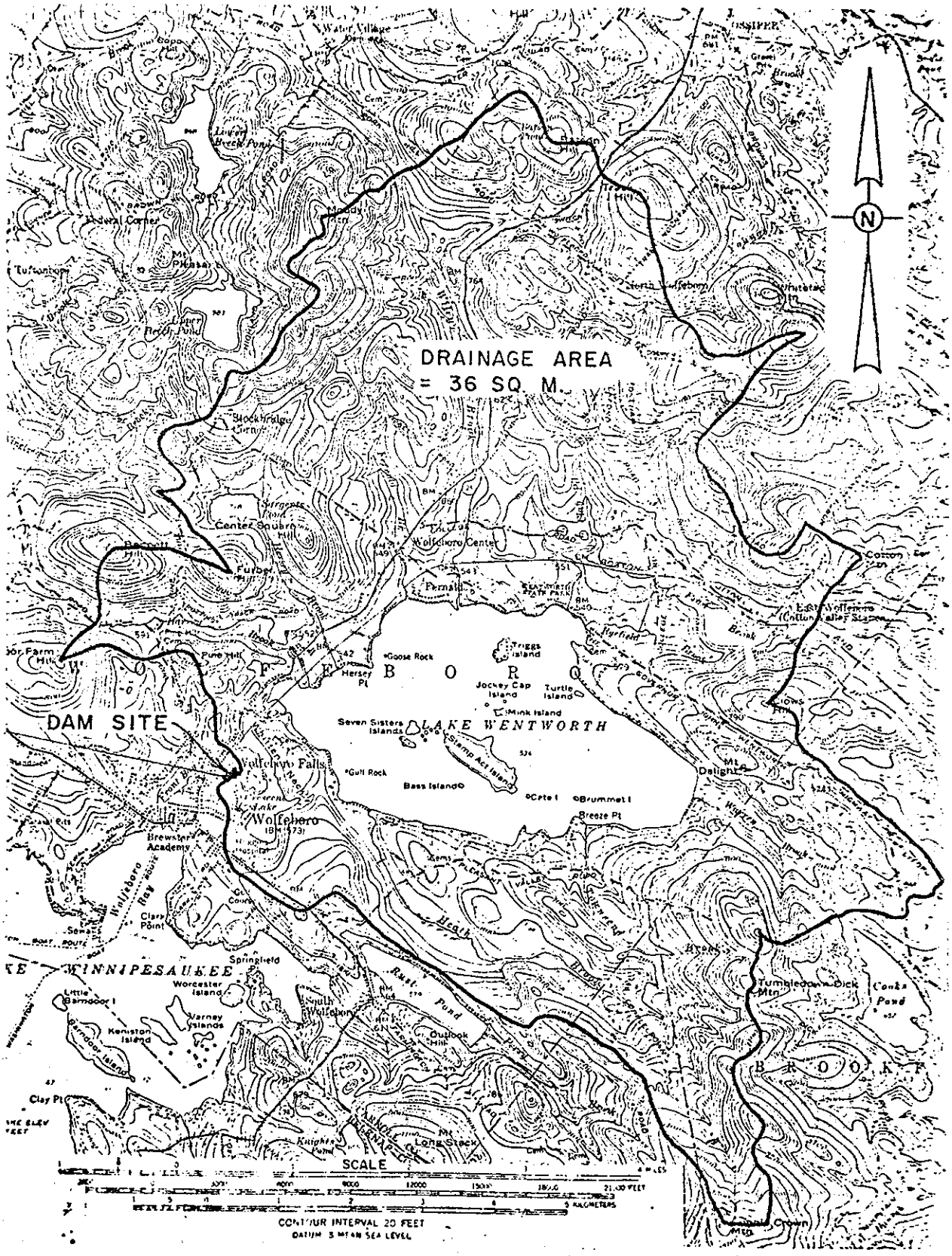
GEOLOGIC MAP
CRESCENT LAKE DAM

DWG. NO. 3

APPENDIX D

HYDROLOGIC COMPUTATIONS

PLATE I APPENDIX D



CRESCENT LAKE DAM
DRAINAGE BASIN

Maximum Probable Flood Peak Flow Rate.

According to NED General Curve

Assume rolling area:

$Q = 2323 - 676.99 \log_{10} A$

$A = 36$ sq. mile.

$\therefore Q = 1269.4$ cfs/sq. mile.

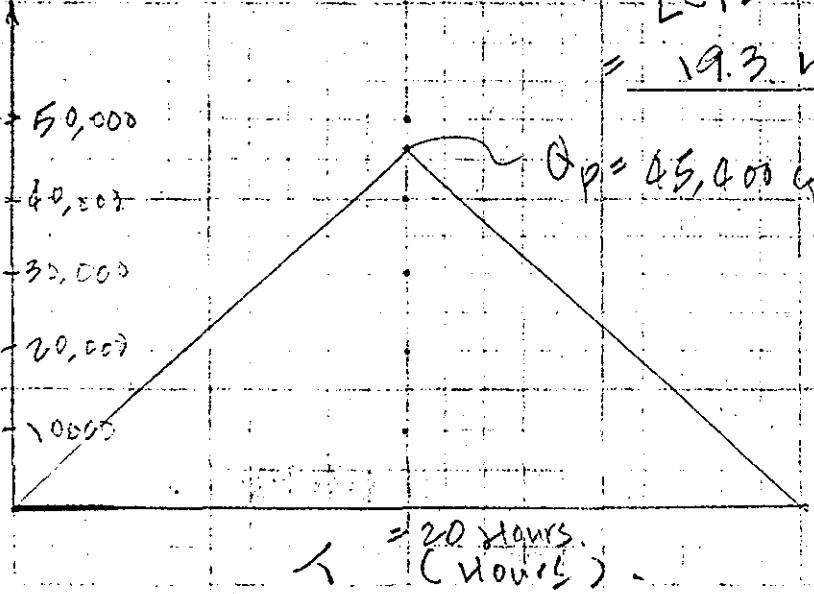
$Q_p = A \times Q = 36 \times 1269.4 = 45,700$ cfs.

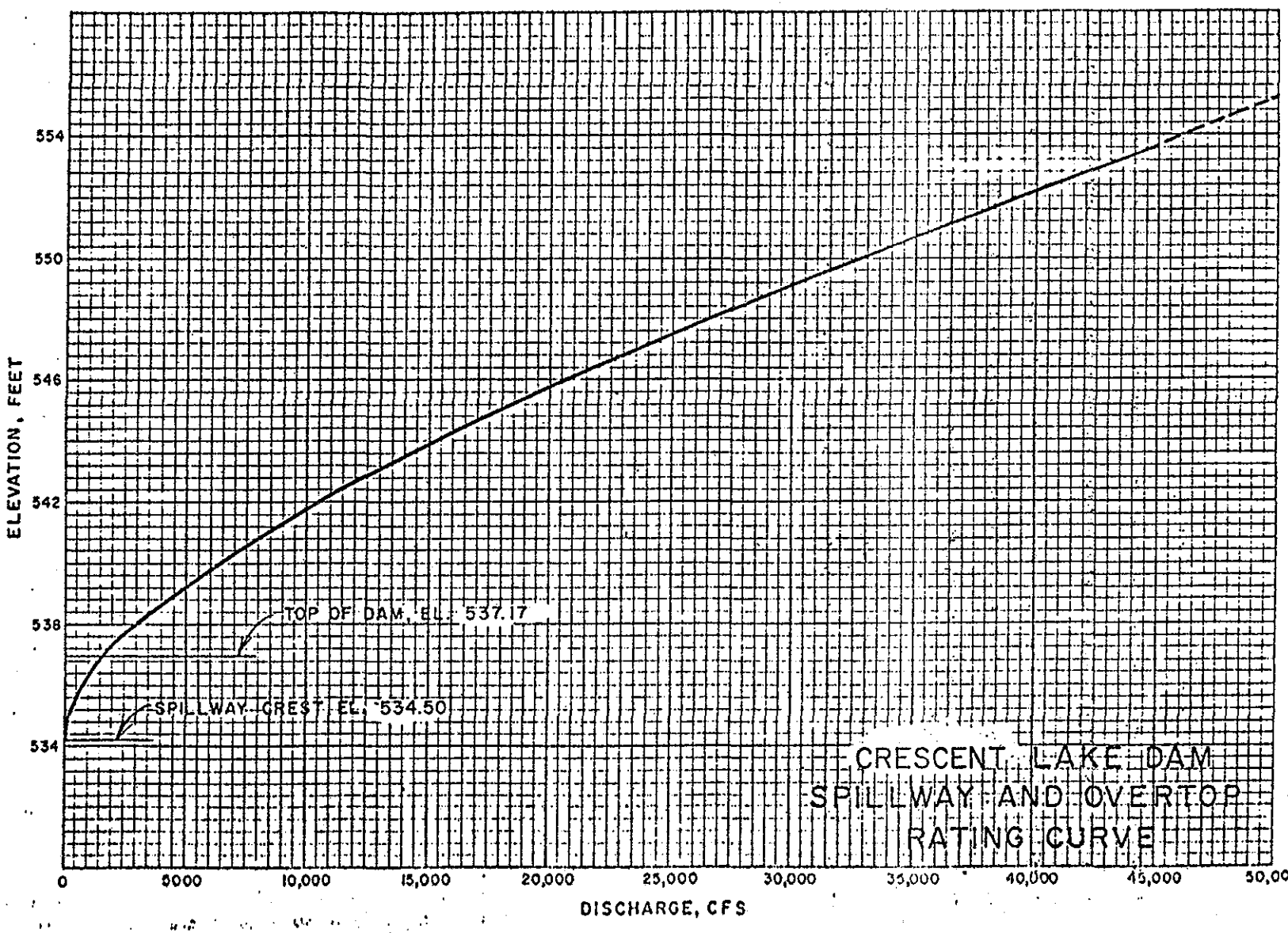
Since MPF runoff in New England equals approx. 19 inches according to NED guideline.

The triangular hydrograph will be approximate to the following shape: $\frac{1}{2} T \times Q_p = 19'' \times A$

$\therefore T = \left[\left(\frac{19}{12}\right) \times 36 \times 27,878,400^2\right] \Big/ 3600 \times Q_p$

$= 19.3$ hours say 20





CRESCENT LAKE DAM
SPILLWAY AND OVERTOP
RATING CURVE

PLATE 2 APPENDIX D

PLATE 3 APPENDIX D

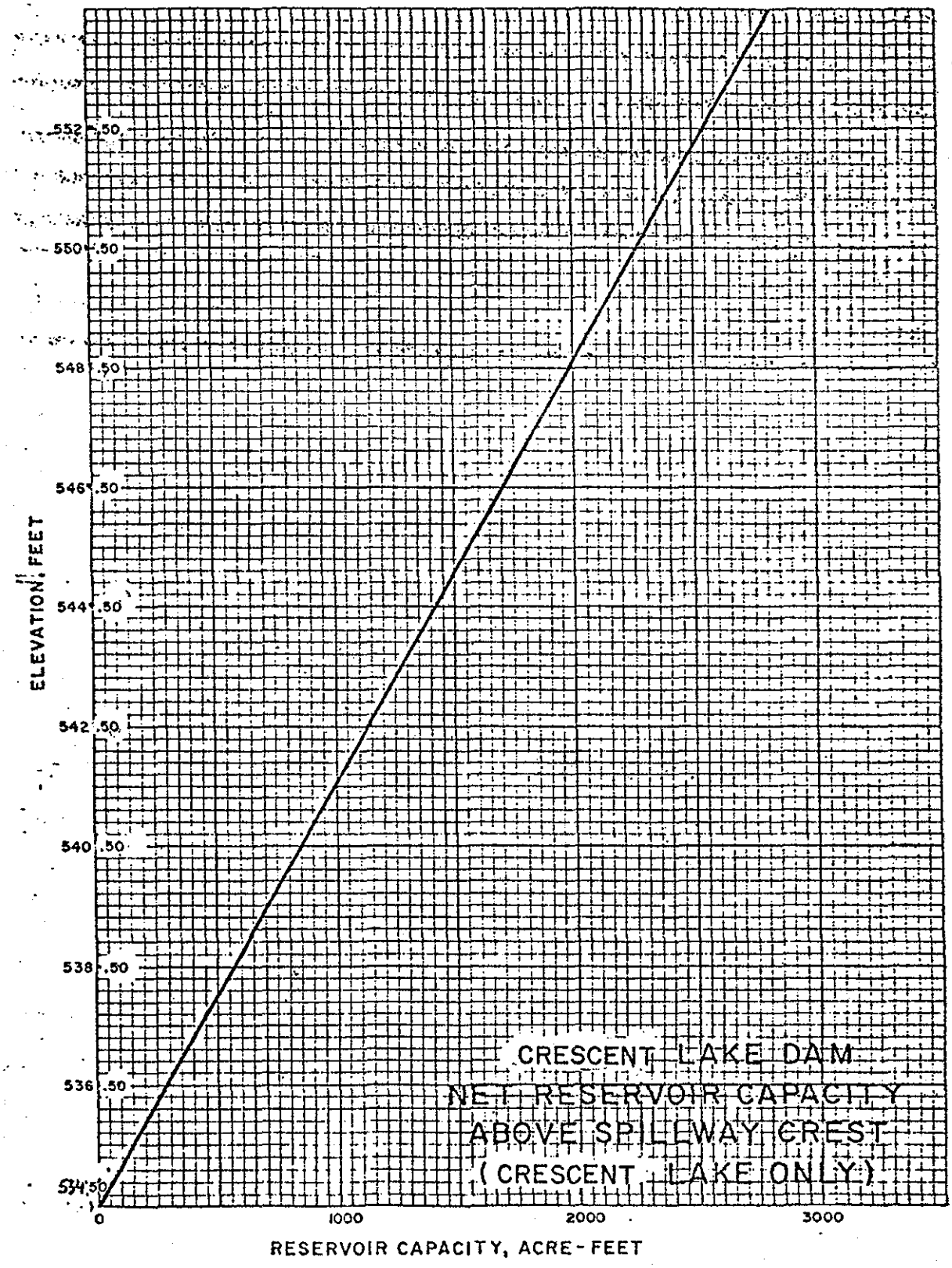
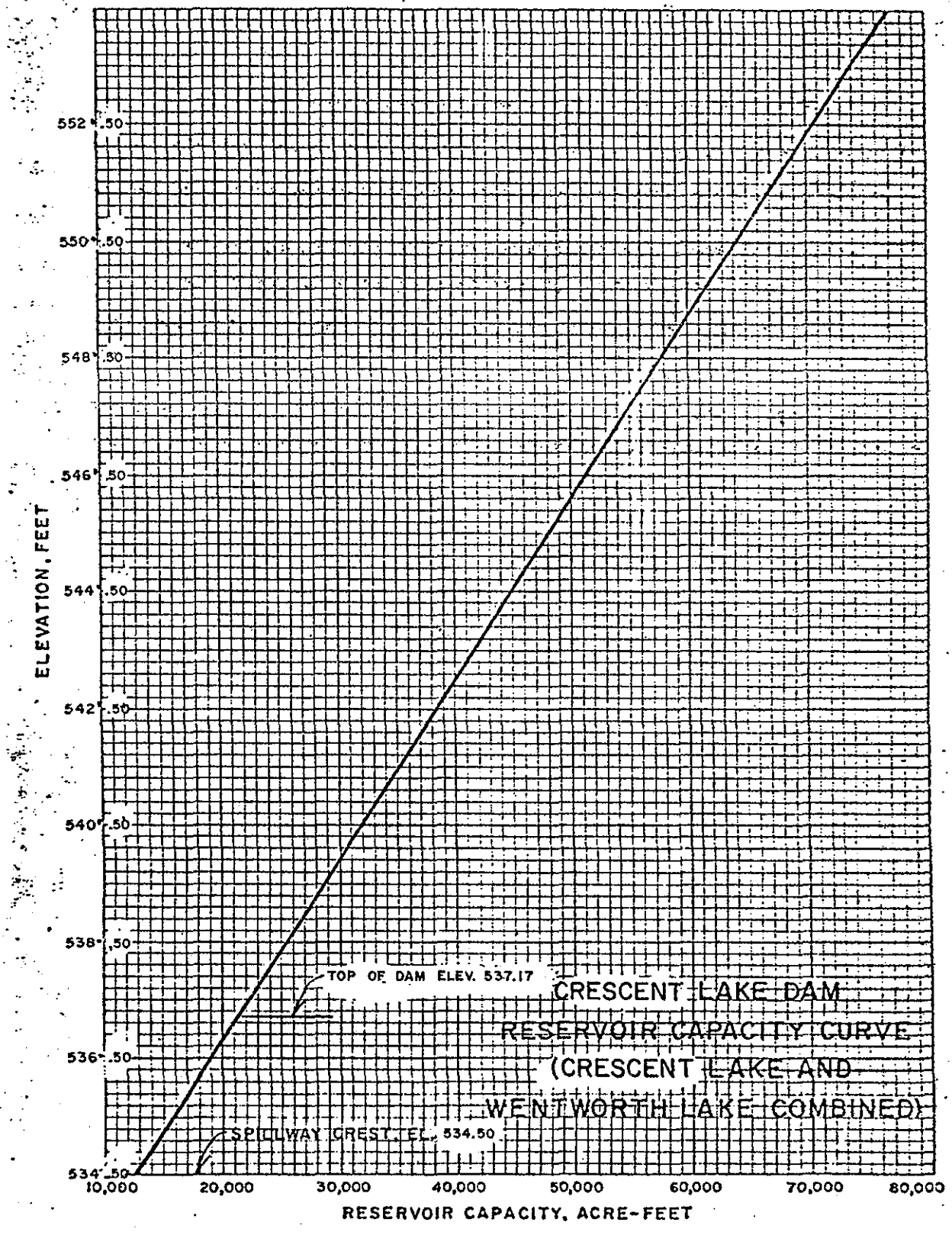


PLATE 4 APPENDIX D



I-4 ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. 1 OF
CRESENT LAKE DAM JOB NO. 1211-001-1
DAM FAILURE STUDY BY KLB DATE 8-4-78

CRESENT LAKE DAM

EFFECT OF DAM FAILURE

STEP 1: PEAK FAILURE OUTFLOW Q_{f_1}:

$$Q_{f_1} = \frac{8}{27} W_b \sqrt{2g}\, y_0^{3/2}$$

W_b = 0.40 x DAM LENGTH ACROSS RIVER AT MIDHEIGHT

ASSUME W_b TO BE EQUAL TO THE WIDTH OF THE WELL DEFINED CHANNEL 20 FT. (FROM SKETCH) FOR DAM FAILURE STUDY.

y_0 = TOTAL HEIGHT FROM RIVER BED TO TOP OF DAM

y_0 = 12' + 2.7' = 14.7' (FROM SKETCH AND RATING CURVE)

$$\therefore Q_{f_1} = \frac{8}{27} \times 20 \times \sqrt{64.4} \times (14.7)^{3/2}$$

$$Q_{f_1} = 2680 \text{ CFS}$$

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. 3 OF 4
CRESENT LAKE DAM JOB NO. 1211-001-1
DAM FAILURE STUDY BY KLB DATE 8-4-78

STEP 2: DEVELOP STAGE DISCHARGE CURVES FOR THE DOWNSTREAM CHANNEL.

THE STAGE - DISCHARGE RATING CURVE JUST DOWNSTREAM OF CRESENT LAKE DAM IS SHOWN ON PAGE 4 (ASSUMPTIONS SAME AS FOR STINSON LAKE DAM)

STEP3: DETERMINE STAGE CORRESPONDING TO Q_{P_1} FROM THE STAGE DISCHARGE RATING CURVE:

PEAK DISCHARGE Q_{P_1} = 2680 CFS

DISTANCE DOWNSTREAM FROM DAM, MILES	0	1
STAGE, FEET	5.0	DRAINS INTO A BAY (FRONT BAY)

ENGINEERING CONSULTANTS, INC.

New Hampshire Dam Safety Inspection — SHEET NO. 1 OF

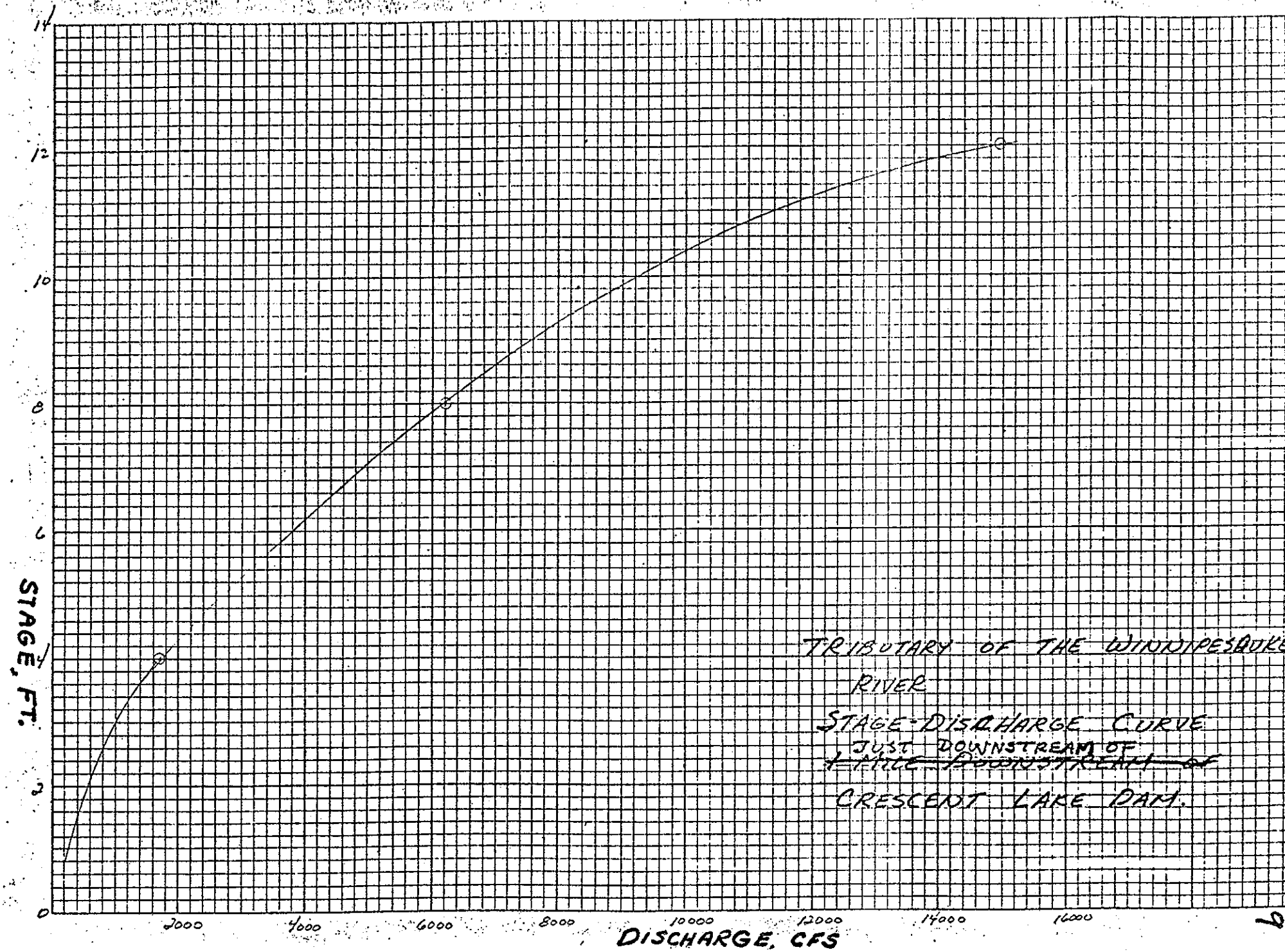
Crescent Lake Dam — JOB NO. 1211-01

DOWNSTREAM CHANNEL RATING CURVE, JUST BELOW THE DAM. — BY M.R.H. DATE 6/28/78

Stage ft.	Area A Sq. ft.	Wetted Perimeter WP ft.	Hydraulic Radius R ft.	$AR^{2/3}$	$Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$ $Q = 1.29\, AR^{2/3}$ cu. ft./sec.
0	0	0	0	0	0
4	630	205	3.07	1330	1716
8	1520	270	5.63	4810	6206
12	2970	385	7.72	11600	14,970
16					
20					

Assume $n = 0.10$

Channel Slope, $S = 10/1320 = 0.00758$ ft./ft.


14
12
10
8
6
4
2
0
STAGE, FT.
2000
4000
6000
8000
10000
12000
14000
16000
DISCHARGE, CFS
TRIBUTARY OF THE WINNIPESAUKEE
RIVER
STAGE-DISCHARGE CURVE
JUST DOWNSTREAM OF
~~1 MILE DOWNSTREAM OF~~
CRESCENT LAKE DAM.

HEC 1 – COMPUTATIONS

****
HEC-1 VERSION DATED JAN 1973
****

DAM SAFETY INSPECTION - NEW HAMPSHIRE
CRESENT LAKE DAM
PMP FLOOD

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	30	0	0	0	0	0	0	0

JOPER	NWT
3	0

*********** *********** *********** *********** ***********

SUB-AREA RUNOFF COMPUTATION

INPUT DERIVED TRIANGULAR SHAPED HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	36.00	0.00	36.00	0.00	0.000	0	0	0

INPUT HYDROGRAPH

0.	2270.	4540.	6810.	9080.	11350.	13620.	15890.	18160.	20430.
22700.	24970.	27240.	29510.	31780.	34050.	36320.	38590.	40860.	43130.
45400.	43130.	40860.	38590.	36320.	34050.	31780.	29510.	27240.	24970.
22700.	20430.	18160.	15890.	13620.	11350.	9080.	6810.	4540.	2270.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	45400.	38590.	18916.	6305.	908000.
INCHES		9.97	19.55	19.55	19.55
AC-FT		19145.	37540.	37540.	37540.

*********** *********** *********** *********** ***********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THRU CRESENT LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	2	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	12500.	19000.	25600.	32000.	38500.	45000.	51500.	58000.	64100.	70500.
OUTFLOW=	0.	1000.	3400.	6500.	10700.	15500.	20600.	26700.	33200.	40000.

TIME	EOP STOR	AVG IN	EOP OUT
1	12500.	0.	0.
2	12546.	1135.	7.
3	12686.	3405.	28.
4	12919.	5675.	64.
5	13243.	7945.	114.
6	13659.	10215.	178.
7	14166.	12485.	256.
8	14764.	14755.	348.
9	15451.	17025.	454.
10	16227.	19295.	573.
11	17091.	21565.	706.
12	18044.	23835.	852.
13	19084.	26105.	1030.
14	20205.	28375.	1438.
15	21403.	30645.	1874.
16	22676.	32915.	2337.
17	24023.	35185.	2826.
18	25444.	37455.	3343.
19	26933.	39725.	4045.
20	28485.	41995.	4797.
21	30100.	44265.	5579.
22	31683.	44265.	6346.
23	33137.	41995.	7235.
24	34462.	39725.	8091.
25	35660.	37455.	8864.
26	36733.	35185.	9558.
27	37685.	32915.	10173.
28	38520.	30645.	10715.
29	39239.	28375.	11245.
30	39844.	26105.	11692.
31	40338.	23835.	12057.
32	40725.	21565.	12343.
33	41008.	19295.	12552.
34	41190.	17025.	12686.
35	41274.	14755.	12748.
36	41263.	12485.	12740.
37	41160.	10215.	12664.
38	40968.	7945.	12523.
39	40690.	5675.	12317.
40	40327.	3405.	12049.
41	39883.	1135.	11721.
42	39405.	0.	11369.
43	38943.	0.	11027.
44	38494.	0.	10696.
45	38058.	0.	10414.
46	37633.	0.	10140.

47	37220.	0.	9872.
48	36817.	0.	9612.
49	36425.	0.	9359.
50	36043.	0.	9112.
51	35672.	0.	8872.
52	35310.	0.	8639.
53	34958.	0.	8411.
54	34615.	0.	8189.
55	34281.	0.	7973.
56	33955.	0.	7763.
57	33639.	0.	7559.
58	33331.	0.	7360.
59	33030.	0.	7166.
60	32738.	0.	6977.
61	32454.	0.	6793.
62	32177.	0.	6614.
63	31907.	0.	6455.
64	31643.	0.	6327.
65	31384.	0.	6201.
66	31130.	0.	6078.
67	30881.	0.	5958.
68	30637.	0.	5840.
69	30399.	0.	5724.
70	30164.	0.	5611.
71	29935.	0.	5499.
72	29710.	0.	5390.
73	29489.	0.	5284.
74	29273.	0.	5179.
75	29061.	0.	5076.
76	28853.	0.	4976.
77	28650.	0.	4877.
78	28450.	0.	4780.
79	28255.	0.	4686.
80	28063.	0.	4593.
81	27875.	0.	4502.
82	27691.	0.	4412.
83	27510.	0.	4325.
84	27333.	0.	4239.
85	27160.	0.	4155.
86	26990.	0.	4073.
87	26823.	0.	3992.
88	26660.	0.	3913.
89	26500.	0.	3836.
90	26343.	0.	3759.
91	26189.	0.	3685.
92	26038.	0.	3612.
93	25890.	0.	3540.
94	25745.	0.	3470.
95	25603.	0.	3401.
96	25464.	0.	3350.
97	25326.	0.	3300.
98	25191.	0.	3251.
99	25058.	0.	3203.
100	24926.	0.	3155.
101	24797.	0.	3108.
102	24669.	0.	3061.
103	24544.	0.	3016.
104	24420.	0.	2971.
105	24298.	0.	2926.
106	24178.	0.	2883.
107	24060.	0.	2840.

108	23944.	0.	2797.
109	23629.	0.	2756.
110	23716.	0.	2715.
111	23604.	0.	2674.
112	23495.	0.	2634.
113	23387.	0.	2595.
114	23280.	0.	2556.
115	23175.	0.	2518.
116	23072.	0.	2480.
117	22970.	0.	2443.
118	22870.	0.	2407.
119	22771.	0.	2371.
120	22674.	0.	2336.
121	22578.	0.	2301.
122	22484.	0.	2267.
123	22391.	0.	2233.
124	22299.	0.	2199.
125	22209.	0.	2167.
126	22120.	0.	2134.
127	22033.	0.	2102.
128	21946.	0.	2071.
129	21861.	0.	2040.
130	21778.	0.	2010.
131	21695.	0.	1980.
132	21614.	0.	1950.
133	21534.	0.	1921.
134	21455.	0.	1892.
135	21378.	0.	1864.
136	21301.	0.	1836.
137	21226.	0.	1809.
138	21151.	0.	1782.
139	21078.	0.	1755.
140	21006.	0.	1729.
141	20935.	0.	1703.
142	20866.	0.	1678.
143	20797.	0.	1653.
144	20729.	0.	1628.
145	20662.	0.	1604.
146	20596.	0.	1580.
147	20531.	0.	1557.
148	20468.	0.	1533.
149	20405.	0.	1510.
150	20343.	0.	1488.
SUM			718925.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12748.	12341.	9309.	4989.	718925.
INCHES		3.18	9.62	15.47	15.48
AC-FT		6122.	18474.	29706.	29722.

RUNOFF SUMMARY: AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	45400.	38590.	18916.	6305.	36.00
ROUTED TO	1	12748.	12341.	9309.	4989.	36.00

****
HEC-1 VERSION DATED JAN 1973
****

DAM SAFETY INSPECTION - NEW HAMPSHIRE
CRESENT LAKE DAM
ONE HALF PMP FLOOD

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	30	0	0	0	0	0	0	0

JOPER	NWT
3	0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT DERIVED TRIANGULAR SHAPED HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	36.00	0.00	36.00	0.00	0.500	0	0	0

INPUT HYDROGRAPH

0.	2270.	4540.	6810.	9080.	11350.	13620.	15890.	18160.	20430.
22700.	24970.	27240.	29510.	31780.	34050.	36320.	38590.	40860.	43130.
45400.	43130.	40860.	38590.	36320.	34050.	31780.	29510.	27240.	24970.
22700.	20430.	18160.	15890.	13620.	11350.	9080.	6810.	4540.	2270.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	45400.	38590.	18916.	6305.	908000.
INCHES		9.97	19.55	19.55	19.55
AC-FT		19145.	37540.	37540.	37540.

RUNOFF MULTIPLIED BY 0.50

0.	1135.	2270.	3405.	4540.	5675.	6810.	7945.	9080.	10215.
11350.	12485.	13620.	14755.	15890.	17025.	18160.	19295.	20430.	21565.
22700.	21565.	20430.	19295.	18160.	17025.	15890.	14755.	13620.	12485.
11350.	10215.	9080.	7945.	6810.	5675.	4540.	3405.	2270.	1135.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	22700.	19295.	9458.	3152.	454000.
INCHES		4.98	9.77	9.77	9.77
AC-FT		9572.	18770.	18770.	18770.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THRU CRESENT LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	2	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	12500.	19000.	25600.	32000.	38500.	45000.	51500.	58000.	64100.	70500.
OUTFLOW=	0.	1000.	3400.	6500.	10700.	15500.	20600.	26700.	33200.	40000.

TIME	EOP STOR	AVG IN	EOP OUT
1	12500.	0.	0.
2	12523.	567.	3.
3	12593.	1702.	14.
4	12709.	2837.	32.
5	12871.	3972.	57.
6	13079.	5107.	89.
7	13333.	6242.	128.
8	13632.	7377.	174.
9	13975.	8512.	227.
10	14363.	9647.	286.
11	14795.	10782.	353.
12	15272.	11917.	426.
13	15792.	13052.	506.
14	16355.	14187.	593.
15	16962.	15322.	686.
16	17612.	16457.	786.
17	18304.	17592.	892.
18	19038.	18727.	1014.
19	19811.	19862.	1295.
20	20620.	20997.	1589.
21	21462.	22132.	1895.
22	22292.	22132.	2197.
23	23063.	20997.	2477.
24	23776.	19862.	2736.

25	24432.	18727.	2975.
26	25032.	17592.	3193.
27	25576.	16457.	3391.
28	26064.	15322.	3624.
29	26496.	14187.	3834.
30	26873.	13052.	4016.
31	27196.	11917.	4173.
32	27467.	10782.	4304.
33	27685.	9647.	4410.
34	27853.	8512.	4491.
35	27971.	7377.	4548.
36	28040.	6242.	4582.
37	28062.	5107.	4592.
38	28037.	3972.	4580.
39	27965.	2837.	4545.
40	27849.	1702.	4489.
41	27688.	567.	4411.
42	27508.	0.	4324.
43	27331.	0.	4238.
44	27158.	0.	4154.
45	26988.	0.	4072.
46	26821.	0.	3991.
47	26658.	0.	3912.
48	26498.	0.	3835.
49	26341.	0.	3759.
50	26187.	0.	3684.
51	26036.	0.	3611.
52	25888.	0.	3539.
53	25744.	0.	3469.
54	25602.	0.	3401.
55	25462.	0.	3350.
56	25325.	0.	3300.
57	25189.	0.	3250.
58	25056.	0.	3202.
59	24925.	0.	3154.
60	24795.	0.	3107.
61	24668.	0.	3061.
62	24542.	0.	3015.
63	24419.	0.	2970.
64	24297.	0.	2926.
65	24177.	0.	2882.
66	24059.	0.	2839.
67	23942.	0.	2797.
68	23827.	0.	2755.
69	23714.	0.	2714.
70	23603.	0.	2673.
71	23493.	0.	2634.
72	23385.	0.	2594.
73	23279.	0.	2556.
74	23174.	0.	2517.
75	23071.	0.	2480.
76	22969.	0.	2443.
77	22869.	0.	2407.
78	22770.	0.	2371.
79	22673.	0.	2335.
80	22577.	0.	2300.
81	22483.	0.	2266.
82	22390.	0.	2232.
83	22298.	0.	2199.
84	22208.	0.	2166.
85	22119.	0.	2134.

86	22031.	0.	2102.
87	21945.	0.	2071.
88	21860.	0.	2040.
89	21777.	0.	2009.
90	21694.	0.	1979.
91	21613.	0.	1950.
92	21533.	0.	1921.
93	21454.	0.	1892.
94	21377.	0.	1864.
95	21300.	0.	1836.
96	21225.	0.	1809.
97	21151.	0.	1782.
98	21077.	0.	1755.
99	21005.	0.	1729.
100	20934.	0.	1703.
101	20865.	0.	1678.
102	20796.	0.	1653.
103	20728.	0.	1628.
104	20661.	0.	1604.
105	20595.	0.	1580.
106	20531.	0.	1556.
107	20467.	0.	1533.
108	20404.	0.	1510.
109	20342.	0.	1488.
110	20281.	0.	1465.
111	20221.	0.	1444.
112	20161.	0.	1422.
113	20103.	0.	1401.
114	20046.	0.	1380.
115	19989.	0.	1359.
116	19933.	0.	1339.
117	19878.	0.	1319.
118	19824.	0.	1299.
119	19771.	0.	1280.
120	19718.	0.	1261.
121	19667.	0.	1242.
122	19616.	0.	1224.
123	19565.	0.	1205.
124	19516.	0.	1187.
125	19467.	0.	1170.
126	19419.	0.	1152.
127	19372.	0.	1135.
128	19325.	0.	1118.
129	19280.	0.	1101.
130	19234.	0.	1085.
131	19190.	0.	1069.
132	19146.	0.	1053.
133	19103.	0.	1037.
134	19060.	0.	1022.
135	19018.	0.	1006.
136	18977.	0.	996.
137	18936.	0.	990.
138	18895.	0.	983.
139	18855.	0.	977.
140	18814.	0.	971.
141	18774.	0.	965.
142	18734.	0.	959.
143	18695.	0.	953.
144	18656.	0.	947.
145	18617.	0.	941.
146	18578.	0.	935.

147	18539.	0.	929.	
148	18501.	0.	923.	
149	18463.	0.	917.	
150	18425.	0.	911.	
SUM			311042.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4592.	4460.	3615.	2158.	311042.
INCHES		1.15	3.73	6.69	6.69
AC-FT		2212.	7174.	12851.	12859.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	22700.	19295.	9458.	3152.	36.00
ROUTED TO	1	4592.	4460.	3615.	2158.	36.00

1901 SOUTH NAVAJO, DENVER, COLORADO 80223

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(10) NAME	(11) LATITUDE (NORTH)	(12) LONGITUDE (WEST)	(13) REPORT DATE DAY | MO | YR
NH	309	NED	NH	003	01				CRESCENT LAKE DAM	4335.4	7112.1	150CT78

(14) POPULAR NAME	(15) NAME OF IMPOUNDMENT
CRESCENT LAKE DAM	CRESCENT LAKE + LAKE WENTWORTH

(16) REGION	(17) BASIN	(18) RIVER OR STREAM	(19) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(20) DIST FROM DAM (MI.)	(21) POPULATION
01	05	SMITH RIVER	WOLFBORO	0	3036

(22) TYPE OF DAM	(23) YEAR COMPLETED	(24) PURPOSES	(25) STRUCTURAL HEIGHT (FT.)	(26) HYDRAULIC HEIGHT (FT.)	(27) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(28) IMPOUNDING CAPACITIES NORMAL (ACRE–FT.)
GRCTTBPG	1854	RS	12	12	21320	12700

DIST OWN FED R PRV/FED SCS A VER/DATE

(29) REMARKS
21=MASONARY=CONCRETE FACING TIMBER

(30) D/S HAS	(31) SPILLWAY CREST LENGTH	(32) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	145	C	130	1780												

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
TOWN OF WOLFBORO		

(49) REGULATORY AGENCY DESIGN	(50) CONSTRUCTION	(51) OPERATION	(52) MAINTENANCE
NH WATER RES BD	NH WATER RES BD	NH WATER RES BD	NONE

(53) INSPECTION BY	(54) INSPECTION DATE DAY | MO | YR	(55) AUTHORITY FOR INSPECTION
HARRIS-LCI ASSOCIATES	06JUN78	PL 92-367

(56) REMARKS